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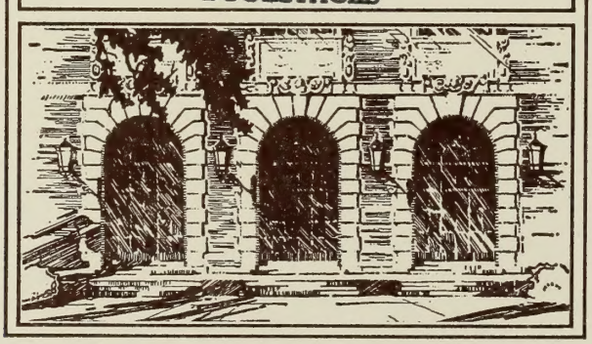

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 1
JANUARY 1, 1971

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

LIBRARY U. OF L., URBANA-CHAMPAIGN

VOLUME 4, NUMBER 1
JANUARY 1, 1971

W71-00001 -- W71-00550

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Federal Water Quality Administration. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1954, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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05 WATER QUALITY MANAGEMENT AND PROTECTION
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

SEA WATER,
Little (Arthur D.), Inc., Cambridge, Mass.
R. A. Horne.
In: Advances in Hydroscience, Vol 6, New York, N.Y., Academic Press, p 107-140, 1970. 134 p, 12 fig, 11 tab, 90 ref.

Descriptors: *Water chemistry, *Water structure, *Sea water, *Reviews, Saline water, Aqueous solutions, Solutes, Water properties, Absorption, Hydrogen ion concentration, Biological properties, Chemical properties, Electrolytes, Nutrients, Trace elements, Oxidation-reduction potential.
Identifiers: Sea water chemistry.

The structure and chemistry of sea water are reviewed. One of the most important recent advances in marine chemistry is the postulation of chemical equilibrium models. The concentrations of major constituents in the more important models are summarized. One of the most complex and certainly one of the most important equilibrium systems in the oceans is the carbonate system, which is fundamental not only to the hydrosphere but to the atmosphere, lithosphere and biosphere as well. This system is believed to maintain the pH of the oceans close to neutrality. Ocean water chemical systems are at least close enough to equilibrium to use equilibrium models. In the immediate neighborhood of the solute a hydration atmosphere is formed. Immediately adjacent to the sodium ion is its 'primary hydration' sheath of 4 strongly bound, tightly electrostricted water molecules. This is in turn surrounded by what is in essence a Frank-Wen cluster. Beyond the region of enhanced water structure is a zone of broken water structure where the Coulombic field is strong enough to disrupt the normal structure of liquid water but not enough to reorient the water molecules. Little is known about the hydration of anions but in general they are believed to be less heavily hydrated than cations. (Knapp-USGS)
W71-00008

RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
Warren H. Philipp, and Stanley J. Marsik.
Available from NTIS as NASA TN D-5880, $3.00 in paper copy, $0.95 in microfiche.National Aeronautics and Space Administration Technical Note, NASA TN D-5880, July 1970. 13 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Radioactivity techniques, *Chemical precipitation, Metals, Metallurgy, Aqueous solutions.
Identifiers: Radiochemistry.

Eleven metals, copper, zinc, cadmium, thallium, tin, lead, antimony, nickel, cobalt, iron, and palladium, were prepared from their aqueous salt solution by irradiation with 2-MeV electrons. In the more successful attempts, the metal yields nG (M) (atoms per 100 eV multiplied by the valence change n) averaged about 2. The yields have been interpreted in terms of the radical scavenging mechanism and the chemistry of the metal system involved. (Knapp-USGS)
W71-00040

02. WATER CYCLE

2A. General

COMPARATIVE HYDROGEOLOGY: AN EXAMPLE OF ITS USE,
Geological Survey, Raleigh, N.C.
Harry E. LeGrand.
Geological Society of America Bulletin, Vol 81, No 4, p 1243-1248, April 1970.6 p, 2 fig, 11 ref.

Descriptors: *Hydrogeology, *Geomorphology, *Surface-groundwater relationships, *North Carolina, Karst, Solubility, Recharge, Groundwater movement, Permeability, Transmissivity, Topography.
Identifiers: Comparative hydrogeology.

As a start toward needed classifications of hydrogeologic settings, a type of setting is described which includes areas where soluble materials are exposed to considerable recharge from precipitation and where both the topographic relief and permeability are small. Typical areas are (1) the Black Belt of the Coastal Plain of Alabama and Mississippi, underlain by chalk of the Selma Group, and (2) a 25-sq-mi area near Harrisburg, Cabarrus County, North Carolina, underlain by gabbro in the Piedmont province. Hydrologic conditions include: excessive evapotranspiration, low water-table gradient, water table near land surface, thin soils, very slow groundwater movement, groundwater movement mainly in the thin soil-rock contact zone, low base flow in streams, low drainage density, and subsurface water relatively high in dissolved mineral matter. Comparative hydrology represents a quick useful means of discerning the significance of processes and principles in particular environements. This setting reveals the significance of solution by subsurface water in developing some plains. Comparative hydrology allows an advanced analysis of some pertinent factors. (Knapp-USGS)
W71-00029

RAINFALL-RUNOFF RELATIONS FOR SOUTHWESTERN LOUISIANA,
Geological Survey, Baton Rouge, La.
F. N. Lee.
Louisiana Department of Public Works Technical Report No 2c, 1969. 91 p, 1 fig, 11 tab.

Descriptors: *Rainfall-runoff relationships, *Louisiana, Depth-area-duration analysis, Data collections, Hydrologic data, Regression analysis, Statistics, Gaging stations, Rain gages, Stream gages.
Identifiers: Southwestern Louisiana.

A method is given for estimating runoff from rainfall in southwestern Louisiana. Two distinct runoff areas are defined by a general exponential formula. Tables list values of the coefficients and exponents calculated for each of the two subareas. Differences in runoff from the two areas are attributed mainly to different soil characteristics. The standard errors of estimate, using all storms for the subareas are about 60% and 80%, respectively. However, as total amounts of runoff increase, the standard errors of estimate decrease. Rainfall, runoff, and storm duration data are tabulated for 1,351 storms analyzed at 37 streamflow stations and 63 rainfall stations. (Knapp-USGS)
W71-00059

PEAK FLOW AND CRITICAL DURATION FOR SMALL WATERSHEDS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W71-00061

THE USE OF ANALOG AND DIGITAL COMPUTERS IN HYDROLOGY.
International Association of Scientific Hydrology, Gentbrugge (Belgium); and United Nations Educational, Scientific and Cultural Organization, Louvain (Belgium).
For primary bibliographic entry see Field 06A.
W71-00071

WATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
J. P. Riley, D. G. Chadwick, and E. K. Israelsen.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 25-37, 1968. 13 p, 9 fig, 11 ref.

Descriptors: *Simulation analysis, *Analog computers, *Hydrologic properties, *Watershed management, *Mathematical models, Water demand, Time, Utah.
Identifiers: Sevier River, Circle Valley.

The problem of the increasing need to assess the downstream consequences resulting from changes at specific locations in a hydrologic system was approached by use of electronic analog simulation. A model was developed for investigating the behavior or response of a dynamic prototype system subject to particular constraints and input functions. Simulation permitted an examination of the composite system involving all processes occurring simultaneously. Studies were undertaken for several watershed areas and involved different time and space increments. Presented were results obtained by simulating a subbasin of the Sevier River drainage in central Utah, referred to as Circle Valley and containing approximately 93,000 acres of mountain watershed and agricultural land. A hydrologic flow diagram was shown representing a basic hydrologic process expressed in mathematical terms. The computer model used synthesized these relationships into a working system. An analog flow chart for the model was also shown. Mean monthly outflow values for 1962 were computed and observed. Analog simulation of other watershed areas was also attempted. (See also W71-00071) (Kriss-Cornell)
W71-00072

ELECTRONIC ANALOG MODELING AS AN AID IN WATER RESOURCE INVESTIGATIONS,
Soil Conservation Service, Hyattsville, Md. Central Technical Unit.
For primary bibliographic entry see Field 06A.
W71-00404

INTERACTIONS OF THE BEACH-OCEAN-ATMOSPHERE SYSTEM AT VIRGINIA BEACH, VIRGINIA,
Army Coastal Engineering Research Center, Washington, D.C.
W. Harrison, and W. C. Krumbein.
Available from NTIS as AD-459 084, $3.00 in paper copy, $0.95 in microfiche. Technical Memerandum No. 7, December 1964. 110 p.
Identifiers: *Beaches, Physical properties, *Ocean waves, Wind, Atmosphere, Mathematical analysis, Virginia, Tidewater, Tides, Velocity, Ocean currents, Sedimentation, Interactions, Erosion, Programming (Computers), Least squares method., Air water interactions, Virginia Beach.

A number of interactions among beach variables are investigated by sequential linear multiregression analysis as programmed for high-speed computers. Study includes influence of beach geometry, wave characteristics, tidal effects, and local wind conditions on velocity of longshore currents, deposition and erosion on the lower forshore and response of grain size and beach slope to shore processes. Most-influential combinations of variables arbitrarily designated as 'process' variables are in general agreement with significant variables of wavetank experimentation, and substantiate intuitive judgments regarding relative importance of these variables on natural beaches. Results suggest that certain additional variables, seldom examined under controlled conditions, be studied in combination with variables normally examined in wave tanks. Time lag between inception of a group of 'processes' and moment of their maximum effect on the 'response' is also investigated.
W71-00468

2B. Precipitation

NEW DEVELOPMENTS IN ATMOSPHERIC WATER RESOURCES,
Bureau of Reclamation, Denver, Colo. Office of Atmospheric Water Resources.
For primary bibliographic entry see Field 03B.
W71-00006

ICE FORMATION BY CONTACT NUCLEATION,
State Univ. of New York, Albany.
For primary bibliographic entry see Field 02C.
W71-00032

OBSERVATIONS OF WATERSPOUTS AND THEIR PARENT CLOUDS,
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.
Vernon J. Rossow.
Available from NTIS as NASA TN D-5854, $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Technical Note, NASA TN D-5854, June 1970. 63 p, 24 fig, 1 tab, 58 ref. 2 append.

Descriptors: *Tornadoes, *Storms, Meteorology, Cloud physics, Storm structure, Weather patterns.
Identifiers: Waterspouts.

Waterspouts were studied during the summers of 1967 and 1968 in the area around Key West, Florida. Observations were made from Coast Guard Cutters and from aircraft. Measurements made of the electric and magnetic fields associated with these atmospheric vortices indicate that electricity does not play a primary role in their structure. Although electricity is eliminated as an essential or defining mechanism, some evidence was found (low cloud tops and a lightening demise of a spout) to indicate that these vortices cannot exist if electricity is too prominent. Of the 104 events sighted, it was found that 30 rotated cyclonically, 9 anticyclonically, and the rest either went unnoticed or were not observable. The parent clouds had tops at 8,000-12,000 ft and bottoms from 800-2,500 ft altitude. The mechanism responsible for the formation of the vortex at the time and location of its occurrence was not determined. The relationship to tornado structure is uncertain. (Knapp-USGS)
W71-00038

ORIGIN AND GEOMORPHOLOGY OF THE THAR DESERT,
Ranchi Univ. (India). Dept. of Geography.
Enayet Ahmed.
Annals of Arid Zone, Vol 8, No 2, p 171-180, September, 1969. 5 ref.

Descriptors: *Geomorphology, *Sands, *Arid lands, *Climatology, History, Geology, Wind erosion, Monsoons, Precipitation (Atmospheric), Weathering, Soil types, Deserts.
Identifiers: *India, *Thar Desert, Archaeology, Desert formation.

The Thar Desert is unique among world deserts because it does not fall in the lee of trade winds. Climatological factors cause the deflection of the southwest monsoons and there are no regional highlands that might cause relief rainfall. On the basis of archaeological finds of human settlements in prehistoric times, it has been theorized that the Thar Desert originated in post-Pleistocene times and that its extensive sand cover is derived by wind transport from the Rann of Kutch. The author argues that the Thar Desert is much older than the human species from the following considerations: (1) Nowhere else in the world are desert sands derived from coastal sands; (2) geological evidence for the existence of much earlier arid condtions; (3) lack of evidence of a shifting desert margin in modern times; (4) the physical impossibility of so much sand originating in the Rann of Kutch. Desert sand is largely quartz, and unlike soft minerals, is resistant to weathering. The strong winds carry away lighter, richer particles and the lack of water prevents clay and silt layering. (Casey-Arizona)
W71-00149

WATER BUDGET IN THE ARID ZONE OF RAJASTHAN DURING 1941-1960,
Central Arid Zone Research Inst., Jodhpur (India).
A. Krishnan, and K. P. Thanvi.
Annals of Arid Zone, Vol 8, No 2, p 291-299, September 1969. 3 fig, 4 tab, 10 ref.

Descriptors: *Arid lands, *Precipitation (Atmospheric), *Evapotranspiration, *Water balance, *Moisture deficit, Monsoons, Groundwater recharge, Soil moisture, Weather data, History, Variability.
Identifiers: India, *Thar Desert, *Rajasthan.

Records of 7 weather stations in arid west Rajasthan from 1941-1960 were analyzed in an attempt to elucidate year to year variability in the various components of water balance. Normally, all stations show a water deficit every month of the year, which decreases considerably during the monsoon season of July to October. During most years there is neither widespread drought nor excess precipitation and even in the wettest year moisture deficiency from January to monsoon onset was high. Generally, moisture surplus in excess of soil water capacity, effecting groundwater recharge, occurs only once in 20 years. (Casey-Arizona)
W71-00153

A STATISTICAL ANALYSIS OF THE RAINFALL OVER THE SUDAN,
Khartoum Univ. (Sudan). Dept. of Geography.
Mahdi Amin El-Tom.
Geographical Journal, Vol 135, No 3, p 378-387, 1969. 7 fig, 4 tab, 5 ref.

Descriptors: *Rainfall, *Climatology, *Monsoons, *Topography, Statistical methods, Regression analysis, Temperature.
Identifiers: *Sudan, *Inter Tropical Convergence Zone, *Latitude, *Line-squalls, Correlation coefficients, Longitudes, Residuals.

Rainfall is the outcome of a combination of many factors. A statistical analysis was made of 4 of these factors especially important in the Sudan. The 4 factors were transferred to equivalent spatial terms: (1) Inter Tropical Convergence Zone (ITCZ)-latitude, (2) relief-altitude, (3) monsoons--a distance and (4) line-squalls--longitudes east of Greenwich, since line-squall effects seem to change in relation to longitudes. A high negative correlation (-0.951) exists between annual rainfall and ITCZ and between the monsoonal factor and annual rainfall (-0.914). Regression lines of all 4 spatial factors on annual rainfall were calculated. All spatial factors, especially (1) and (3) were intercorrelated to some extent. The effect was eliminated by a partial regression analysis. The total annual percentage contribution of the 4 factors to rainfall was 92.76 with 90.48 being contributed by (1) alone. Residual patterns roughly follow longitudes, indicating that other factors, possibly local temperature, also effect Sudanese rainfall. (Casey-Arizona)
W71-00159

ESTIMATES OF EVAPORATION IN EAST AFRICA IN RELATION TO CLIMATOLOGICAL CLASSIFICATION,
East African Agriculture and Forestry Research Organization (Kenya).
For primary bibliographic entry see Field 02D.
W71-00160

ON THE POSSIBILITY OF WEATHER MODIFICATION BY AIRCRAFT CONTRAILS,
Alaska Univ., College. Geophysical Inst.
Wallace B. Murcray.
Monthly Weather Review, Vol 98, No 10, p 745-748, October 1970. 4 p, 11 ref. HEW Grants APOO 449-01, APOO 440-02, and APO 00449-03, NSF grant GA-19475.

Descriptors: *Clouds, *Aircraft, *Air pollution effects, *Cloud seeding, *Weather modification, Air pollution, Cloud physics, Chemistry of precipitation, Precipitation (Atmospheric).
Identifiers: Contrails, Ice fog.

The possible effect of contrails in modifying the weather is reconsidered in the light of information obtained from ground-level contrails in Alaska. It appears likely that inadvertent cloud seeding by jet aircraft may be of the same order of magnitude as that attained in commercial cloud seeding operations. Further investigation is needed; but in the meantime, the possibility of contrail contamination should be kept in mind when evaluating the results of seeding operations. (Knapp-USGS)
W71-00369

EFFECTS OF HURRICANES CAMILLE AND LAURIE ON THE BARATARIA BAY ESTUARY,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W71-00379

BEACH CHANGES BY EXTRAORDINARY WAVES CAUSED BY HURRICANE CAMILLE,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W71-00380

EFFECTS OF HURRICANE CAMILLE ON THE LANDSCAPE OF THE BRETON-CHANDELEUR ISLAND CHAIN AND THE EASTERN PORTION OF THE LOWER MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02J.
W71-00381

METEOROLOGICAL ASPECTS OF HURRICANE CAMILLE--AUGUST 14-22, 1969,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Shih-Ang Hsu.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 5-11, February 1970. 7 p, 1 fig, 1 tab, 2 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Storm structure, *Louisiana, *Appalachian Mountain region, *Hurricanes, Meteorology, Data collections, Meteorological data, Cata collections, Atmospheric pressure, Rainfall, Wind velocity.
Identifiers: Hurricane camille (1969).
W71-00382

SULFUR: SIMULATED LONG-RANGE TRANSPORT IN THE ATMOSPHERE,
Battelle Memorial Inst., Seattle, Wash.
For primary bibliographic entry see Field 05B.
W71-00385

AIR POLLUTION SURVEILLANCE SYSTEMS,
National Air Pollution Control Administration, Cincinnati, Ohio. Bureau of Criteria and Standards
For primary bibliographic entry see Field 05B.
W71-00394

EFFECT OF RAINFALL ON THE VELOCITY DISTRIBUTION AND TRACTIVE FORCE IN A TRIANGULAR OPEN CHANNEL,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering; and Auburn Univ., Ala. Dept. of Agricultural Engineering
For primary bibliographic entry see Field 08B.

W71-00405

PREDICTING PRECIPITATION TYPES,
Weather Bureau, Salt Lake City, Utah. Western Region.
Robert J. C. Burnash, and Floyd E. Hug.
Available from NTIS as PB-190 962, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum WR-49, March 1970. 12 p.
Identifiers: *Atmospheric precipitation, *Weather forecasting, Snow, Rainfall, Ice, Radiosondes, Surface properties, Dew point, Classification, Heat transfer, Atmospheric sounding, Cooling, Utah.

The report discusses possibilities of distinguishing precipitation types. The fact that California's primary snow areas are located at a considerable distance from radiosonde stations made it necessary to place two data requirements on cases to be analyzed: (1) The wind direction at a radiosonde station must be stable enough to indicate air mass characteristics that would be advected to a definable sector of the precipitation area. (2) Information from the precipitation area must be adequate to determine the level at which snow changes to rain. A study of data for the period 1955-1967 inclusive meeting these requirements led to selection of two primary criteria which would be useful in predicting the level at which snow would change to rain. Depth of the moist layer colder than zero degrees Celsius, and heat required to convert falling snow to rain.
W71-00451

TECHNIQUES FOR FORECASTING LOW WATER OCCURENCES AT BALTIMORE AND NORFOLK,
Weather Bureau, Silver Spring, Md. Techniques Development Lab.
James M. McClelland.
Available from NTIS as PB-191 744, $3.00 in paper copy, $0.95 in microfiche. ESSA Technical Memorandum WBTM TDL 28, March, 1970. 43 p.
Identifiers: *Harbors, Shipping (Marine), *Tides, Weather forecasting, Regression analysis, Barometric pressure, Meteorological charts, Ships (Nonmilitary), Chesapeake Bay, Baltimore (Maryland), Norfolk (Virginia), Air water interactions.

The report describes the development of manual techniques for forecasting low water occurrences at Baltimore and Norfolk, Each technique is based on a regression equation, derived by the multiple correlation-screening process, which requires certain surface wind and pressure data from three Chesapeake Bay stations. The minimum and maximum time lags for each equation are 6 and 24 hours, respectively. Tests on independent data from Baltimore and Norfolk show root-mean-square errors of 0.6 feet and 0.4 feet, respectively. These techniques can be useful forecast aids when used under synoptic conditions favorable for low water occurrences.
W71-00467

2C. Snow, Ice, and Frost

ICE PRESSURE ON ENGINEERING STRUCTURES,
Laval Univ., Quebec. Dept. of Civil Engineering.
Bernard Michel.
U S Army Corps of Engineers Cold Regions Research and Engineering Laboratory Science and Engineering Monograph III-B1b, June 1970. 71 p, 39 fig, 10 tab, 79 ref. Project DA 1T062112A130.

Descriptors: *Ice loads, *Hydraulic structures, *Reviews, *Bibliographies, Ice, Ice jams, Reservoirs, Dams, Pressure, Loads (Forces), Engineering structures.
Identifiers: Ice pressure.

One of the most important forces in the design of a dam in northern regions is the horizontal thrust applied to the structure by a solid sheet of ice. There have been few reported dam failures caused by ice pressure and some engineers have doubted the advisability of making substantial allowances for this pressure in the design of hydraulic structures. But measurements made during the last few years leave no doubt as to its importance. Extensive measurements were made from 1946 to 1951 at several reservoirs in the mountains of Colorado. Indenter and strain gages were set in thin mortar panels that could be installed on the face of the walls and at sites exposed to ice thrust. The maximum measured ice pressure at Eleven Mile Canyon was 16 kips/ft in 1947-48, 14 kips/ft in 1948-49 and 20 kips/ft in 1949-50. The highest thrust of all, 17 kips/ft, was recorded at Tarryall Reservoir which has steep rocky shores in the vicinity of the dam. This monograph summarizes and reviews existing knowledge on forces exerted by an expanding ice sheet, impact forces of ice on structures, and vertical forces exerted by ice on hydraulic structures. Sections are also devoted to icebreakers and ice models. A bibliography of 79 entries is included. (Knapp-USGS)
W71-00012

ICE FORMATION BY CONTACT NUCLEATION,
State Univ. of New York, Albany.
Narayan R. Gokhale.
New York State University at Albany Scientific Report, June 1970. 54 p, 20 fig, 19 ref, 4 append.NSF Grants GA328 and GA839.

Descriptors: *Nucleation, *Freezing, *Cloud seeding, *Chemistry of precipitation, Condensation, Particle size, Silver iodide, Laboratory tests.
Identifiers: Contact nucleation.

An investigation of the phenomenon of ice nucleation in water drops due to contact by dry particles at their surfaces was made by observing and photographing the freezing of a large number of water drops. Particles are much more effective in freezing water drops by contact at their surfaces than when they are embedded in the drops. The shift toward warmer temperatures is in the range of 5 to 10C depending on the material. Particles have considerably higher effect on nucleating water drops which are supercooled before the particles land on the surface, than the drops which are not supercooled. The effective degree of supercooling of drops for silver iodide is -5C and for silicate material -8C. Among the materials tested, AgI particles are the most effective in contact nucleation. This shows that a surface structure of the particle similar to that of ice from the point of view of crystal symmetry, and lattice dimensions seems to be important in this mechanism. The freezing is initiated by the particle at the point of contact on the surface of a drop. The surface film freezes first and then the interior of the drop freezes. The best results are obtained in freezing freely suspended millimeter-size water drops in clouds by contact nucleation if silver iodide particles are introduced in the region where the degree of supercooling is at least -5C. (Knapp-USGS)
W71-00032

DYNAMIC YOUNG'S MODULUS AND FLEXURAL STRENGTH OF SEA ICE,
Army Terrestrial Sciences Center, Hanover, N.H.
Guenther E. Frankenstein, and Robert Garner.
Army Cold Regions Research and Engineering Laboratory Technical Report 222, May 1970. 14 p, 4 fig, 2 tab, 10 ref, append. DA Task No 1T062112A13001.

Descriptors: *Sea ice, *Youngs modulus, *Shear strength, *Elastic deformation, *Deflection, Strength of materials, Elastic theory, Tensile strength, Deformation, Elasticity (Mechanical).
Identifiers: Elastic properties (Ice).

Tests were made to determine the dynamic Young's modulus of sea ice. The ice samples were mainly parallelepipeds but a few were 7.62-cm-diam cores. The longitudinal wave velocity (a function of Young's modulus) was determined by measuring the time required for a sound wave to travel the length of the sample. The measured wave velocities were corrected, by Love's frequency equation, to apply for infinite wavelengths. The flexural strength of the ice was determined by conducting a number of simple beam tests. The average value for the flexural strength was 11.3 kg/sq cm. (Knapp-USGS)
W71-00043

PHASE BOUNDARY WATER IN FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02G.
W71-00044

DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
K. A. Linell, and C. W. Kaplar.
Army Materiel Command Cold Regions Research and Engineering Laboratory Technical Report 150, August 1966. 12 p, 7 fig.

Descriptors: *Frozen soils, *Soil classifications, *Permafrost, Soil physical properties, Freezing, Thawing, Soil water, Ice, Soil chemical properties.
Identifiers: Frozen soil classification.

The description and classification of frozen soils is presented as an extension of the Unified Soil Classification System adopted by the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation in 1952. Descriptions, based on physical appearance, are nongenetic and are applicable to both naturally and artificially frozen soils. Field identification data pertaining to frozen soils and those pertinent properties of frozen materials which can be measured by physical tests are indicated. Also, guides are presented for construction on soils subject to freezing and thawing. The report includes photographic illustrations of frozen soil types; a chart showing relationships between unit dry weight of soil, water content, and ice volume; and an example of graphical presentation of frozen soil data. (Knapp-USGS)
W71-00068

GROUNDWATER IN THE PERMAFROST REGIONS OF ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00373

STUDIES OF MORPHOLOGY AND STREAM ACTION ON ABLATING ICE. PART I. MORPHOLOGY AND STRUCTURE OF AN ICE-CORED MEDIAL MORAINE, KASKAWULSH GLACIER YUKON,
Arctic Inst. of North America, Washington, D.C.
S. R. Loomis.
Available from NTIS as AD-709 616, $3.00 in paper copy, $0.95 in microfiche. Arctic Institute of North America, Research Paper No. 57, Wash. D.C. January 1970. 167 p. Army Research Office Support.
Identifiers: *Glaciers, Yukon Territory, Ice, Ablation, Structural properties, Rock (Geology), Fluid flow, Transport properties, Surface, Friction, Thickness, Meeting, Terrain, Inland waterways, Snow, Gravel, Deposits, Soils, *Kaskawulsh glacier (Yukon Territory), Stream morphology, Moraines, Lithology, Topographic profiles.

Part I, 'Morphology and Structure of an Ice-Cored Medial Moraine, Kaskawulsh Glacier, Yukon, describes morphological and lithological characteristics of a medial moraine and their relationship to ablation and flow processes on Kaskawulsh Glacier. Part II, 'Channel Adjustments and Supraglacial Streams,' describes the seasonal evolution of a supraglacial stream in terms of stream morphology and energy exchange on the Capps Glacier. Part III, 'Supraglacial Streams on the Kaskawulsh Glacier, Yukon Territory,' classifies supraglacial streams on

the Kaskawulsh Glacier in relation to structure, morphology, bet material, and seasonal processes.
W71-00442

PHASE BOUNDARY WATER IN FROZEN SOILS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Duwayne M. Anderson.
Available from NTIS as AD-706 840, $3.00 in paper copy, $0.95 in microfiche. Research Report 274, May 1970. 24 p, 8 fig, 41 ref.
Identifiers: *Arctic regions, Soils, *Soils, Water, Freezing, Melting, Interfaces, Ice, Silicates, Air, Heat transfer, Montmorillonite, Remote areas.

It is now widely recognized that water a phase boundaries plays an important and in some cases the dominant role governing heat and mass transport, electrical conduction, transmission of compression waves and other processes of importance in frozen soils. There is also an increasing recognition of the contrast between the complexity of the phenomenology of freezing and thawing and the crudeness of the concepts and models that so far have been available. This report summarizes presently accepted concepts and information and sketches an area where significant advances in knowledge are to be expected.
W71-00462

THERMAL ANALYSIS OF ABOVE-GROUND LIQUID DISTRIBUTION SYSTEMS (UTILIDORS) FOR POLAR APPLICATION,
Naval Civil Engineering Lab., Port Hueneme, Calif.
For primary bibliographic entry see Field 08A.
W71-00465

2D. Evaporation and Transpiration

IMPLICATIONS OF A TYPE OF EMPIRICAL EVAPORATION FORMULA FOR LAKES AND PANS,
Cornell Univ., Ithaca, N.Y.
Wilfried Brutsaert, and Gour-Tsyh Yeh.
Research supported by Federal Water Pollution Control Administration.Water Resources Research, Vol 6, No 4, p 1202-1208, August 1970. 7 p, 1 fig, 22 ref.

Descriptors: *Evaporation, *Equations, *Mass transfer, *Evaporation pans, Mathematical models, Lakes, Winds, Advection, Turbulence, Diffusion, Reservoir evaporation, Water temperature.
Identifiers: Lake evaporation.

Empirical mass transfer formulas for evaporation from lakes and from pans at ground level are compared with the theoretical solution based on semiempirical turbulent diffusion theory in conjunction with Reynolds analogy and the power law for the wind profile. It was found that although the theory has its limitations, it is a useful tool for the study of evaporation, especially under conditions of lateral advection. The empirical formulas should be adequate for many design problems. (Knapp-USGS)
W71-00024

ESTIMATES OF EVAPORATION IN EAST AFRICA IN RELATION TO CLIMATOLOGICAL CLASSIFICATION,
East African Agriculture and Forestry Research Organization (Kenya).
M. Dagg, and J. R. Blackie.
Geographical Journal, Vol 136, No 2, p 227-234, 1970. 3 fig, 3 tab, 18 ref.

Descriptors: *Evapotranspiration, *Climatology, *Solar radiation, *Evaporation, Semiarid climates, Seasonal, Temperature, Land use, Water balance, Water consumption (Excludes consumptive use), Evaporation pans, Climatic data.
Identifiers: Pans, Thornthwaite climatological classifications, Africa, Equatorial conditions.

Accurate climatological classification is important in underdeveloped lands in order to facilitate realistic planning for agricultural development. The water balance of a forested catchment area at Kericho, Kenya, was measured over a period of 8 years (1958-1968) and evapotranspiration was compared to those calculated from various climatic classification theories. The Thornthwaite and Olivier methods considerably underestimated evaporation while the class 'A' pan and Penman methods not only closely agreed with measurements but also showed a realistic seasonal variation. It is argued that the greater accuracy of Penman's methods over others was due to the use of radiation data which are less conservative than temperature data and more appropriate to equatorial climatic conditions. In drier arid regions evaporation may be little related to evapotranspiration from well water transpiration surfaces. Using Thornthwaite's evaporation estimates, the area was classified Humid B2. With Penman's data, classification is dry sub-humid C1 and is probably more useful to land-use planners. (Casey-Arizona)
W71-00160

EFFECT OF WATER-TABLE LEVELS ON EVAPOTRANSPIRATION AND CROP YIELD,
Agricultural Research Service, Raleigh, N.C. Soil and Water Div.
R. E. Williamson, and John R. Carreker.
Americal Society Africultural Engineers Transactions, Vol 13, No 2, p 168-170, March-April 1970. 3 p, 4 fig, 5 tab.

Descriptors: *Evapotranspiration, *Model studies, Rainfall, Soils, Water table, Crops.
Identifiers: *Water-table levels, *Crop yield, Soil tanks.

Crops were grown in soil tanks with different depths to the water table in 1959 to 1964, inclusive. Six tanks were without shelters and subjected to rainfall, and 48 tanks were protected from rain by rain-controlled, electrically operated shelters. Surface soils used in these tanks were Norfolk fine sandy loam in the nonsheltered tanks, fine sandy loam in 20 sheltered tanks, and Bayboro loam in 28 sheltered tanks. No attempt was made to reconstruct the soil profiles. These soils were adjusted initially to pH 6.0 with dolomitic limestone. Fertilizer and lime were mixed into the top 6 in. each year. Salt content was monitored and the sheltered tanks were leached as necessary to prevent a buildup of salts. Water-table levels were established 2 to 3 weeks after crops were planted. The depths to water were 6, 18, and 30 in. in the nonsheltered tanks and 6, 12, 18, 24 and 30 in. in the sheltered tanks 3 ft. deep. Additional levels of 36 and 40 in. were maintained in the sheltered tanks 4 feet deep. Daily rates of evapotranspiration in the sheltered tanks generally were slightly higher for the 12-in. depth to water table than for the 6-in. depth. The rate then tended to decline as depth increased with most crops. Tables and curves relating rainfall, water tables, soils, and crops to evapotranspiration are presented. (Woodard-USGS)
W71-00219

STOCHASTIC ASPECTS OF LAKE ONTARIO EVAPORATION,
Rutgers - The State Univ., New Brunswick, N.J.
Shaw L. Yu, and Wilfried Brutsaert.
Water Resources Research, Vol 5, No 6, Dec 1969. p 1256-1266, 7 fig, 5 tab, 13 ref.

Descriptors: *Lake Ontario, *Evaporation, *Stochastic processes, *Meteorology, *Correlation analysis, Wind velocity, Markov processes, Air temperature, Lakes.
Identifiers: Water budget.

Time series analysis was carried out on long-term monthly mean values of evaporation from Lake Ontario, which were generated in an earlier study, and on related meteorologic parameters. Correlation and spectral analyses showed that the annual cycle was dominant in all the time series. Evaporation is usually high in autumn and winter and low in spring and summer. A warming trend was observed in the air temperature and a drying trend in the relative humidity series. Except for the wind speed, no significant trend was found for the other time series. Cross correlation and cross-spectral analyses showed a close relationship between evaporation anomalies and the anomalies of the other parameters. A first order Markov model adequately described the evaporation, air temperature, and relative humidity anomalies, whereas a second order model fitted the anomalies of wind speed and water surface temperature. Morton's (1967) water budget method yields higher evaporation estimates in the summer and lower estimates in the winter than the mass transfer estimates. (Upadhyaya-Vanderbilt)
W71-00233

ESTIMATING STEADY-STATE EVAPORATION RATES FROM BARE SOILS UNDER CONDITIONS OF HIGH WATER TABLE,
Geological Survey, Menlo Park, Calif.
C. D. Ripple, J. Rubin, and T. E. A. van Hylckama.
Geological Survey, Open-file report, 1970. 62 p, 10 fig, 28 ref, append.

Descriptors: *Evaporation, *Soil water movement, *Groundwater movement, *Air-earth interfaces, Water table, Humidity, Temperature, Mass transfer, Meteorology, Hydraulic conductivity.
Identifiers: Evaporation from bare soil.

A procedure that combines meteorological and soil equations of water transfer makes it possible to estimate approximately the steady-state evaporation from bare soils under conditions of high water table. Field data required include soil-water retention curves, water table depth and a record of air temperature, air humidity and wind velocity at one elevation. The procedure takes into account the relevant atmospheric factors and the soil's capability to conduct water in liquid and vapor forms. It neglects the effects of thermal transfer (except in the vapor case) and of salt accumulation. Homogeneous as well as layered soils can be treated. Results obtained with the method demonstrate how the soil evaporation rates depend on potential evaporation, water table depth, vapor transfer and certain soild parameters. (Knapp-USGS)
W71-00370

EVAPOTRANSPIRATION AS AFFECTED BU PLANT DENSITY AND WATER-TABLE DEPTH,
Agricultural Research Service, Fort Lauderdale, Fla. Plantation Field Lab.
E. H. Stewart, J. E. Browning, and E. O. Burt.
American Society of Agricultural Engineers Transactions, Vol 12, No 5, p 646-647, September-October 1969. 2 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Evapotranspiration, *Soil-water-plant relationships, *Vegetation effects, *Water table, Model studies, Rainfall, Soil structure, Lysimeters, Irrigation effects.
Identifiers: Evapotranspirometers.

Evapotranspiration data from Tifway bermudagrass were obtained with nonweighing evapotranspirometers at the Plantation Field Laboratory near Fort Lauderdale, Fla. The installations consist of 12 waterproof rectangular concrete tanks, 5 ft deep, each having a plot area of approximately 1/1,000 acre. The soil was removed from excavation site and replaced inside and outside the tanks in approximately 1-ft layers to reconstruct the original soil profile as closely as possible. Relationships were linear between degree of plant cover and annual evapotranspiration of Tifway bermudagrass grown on Arzel fine sand with 12-, 24-, and 36-inch water tables. Evapotranspiration increased with sod cover at water-table depths of 24 and 36 inches, but decreased slightly with cover for the water-table depth of 12 inches. The ratio between evapotranspiration from no sod or a partial sod and a full sod was related to the depth to water table

and the amount, frequency, and distribution of rainfall. Graphs, tables of data, and a picture of the model are included. (Woodard-USGS)
W71-00402

2E. Streamflow and Runoff

EFFECTS OF DENSITY DIFFERENCES ON LATERAL MIXING IN OPEN-CHANNEL FLOWS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources.
For primary bibliographic entry see Field 05B.
W71-00005

FLORIDA WATER AND RELATED LAND RESOURCES--ST. JOHNS RIVER BASIN.
Florida Dept. of Natural Resources, Tallahassee.
For primary bibliographic entry see Field 06B.
W71-00010

COMPILATION OF HYDROLOGIC DATA, ESCONDIDO CREEK, SAN ANTONIO RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Copies of report may be obtained at U S Geological Survey, WRD, Federal Bldg, 300 E 8th St, Austin, Texas 78701. Geological Survey Open-file report, 1970. 73 p, 2 fig, 3 tab.

Descriptors: *Rainfall, *Runoff, *Streamflow, *Texas, Discharge measurement, Stream gages, Storm runoff, Peak discharge, Low flow, Average flow, Hydrographs, Mass curves.
Identifiers: *Escondido Creek (Kenedy, Texas), Weighted-precipitation record, Inflow and outflow computation.

This report contains rainfall and runoff data collected during the 1968 water year (October 1967 to September 1968) for the 72.4 square-mile area above stream-gaging station Escondido Creek at Kenedy, Texas. Monthly and yearly rainfall and runoff data from 1954 to 1968 are included. The location of floodwater-retarding structures and hydrologic instruments in the area are shown. Current objectives of the study are to determine the net effect of floodwater-retarding structures on the regimen of streamflow at downstream points; to develop computation techniques that will provide more accurate estimates of runoff resulting from a given amount of rainfall on small watersheds; to develop relationships between maximum rates of runoff and rainfall in small watersheds that will enable more accurate design of small storm-drainage structures; and to determine the minimum instrumentation necessary to make reliable estimates of total storm inflow to the structures. (Woodard-USGS)
W71-00013

COMPARATIVE HYDROGEOLOGY: AN EXAMPLE OF ITS USE,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02A.
W71-00029

WATERSHED RESEARCH IN WESTERN NORTH CAROLINA - A STUDY OF THE EFFECTS OF AGRICULTURAL COVERS UPON THE HYDROLOGY OF SMALL WATERSHEDS.
Tennessee Valley Authority, Knoxville, and North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 04A.
W71-00033

CIRCULATION, EFFLUENT DIFFUSION, AND SEDIMENT TRANSPORT, MOUTH OF SOUTH PASS, MISSISSIPPI RIVER DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 05B.
W71-00036

COMPILATION OF HYDROLOGIC DATA, AUSTIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Copies of this report may be obtained at US Geological Survey, WRD, Federal Bldg, 300 E 8th St, Austin, Texas 78701. Geological Survey Open-file report, 1970. 68 p, 3 fig, 1 tab.

Descriptors: *Streamflow, *Discharge measurement, *Urbanization, *Texas, Rainfall, Runoff, Stream gages, Peak discharge, Low flow, Average flow.
Identifiers: *Waller Creek watershed (Austin, Texas), *Wilbarger Creek watershed (Travis County, Texas).

Rainfall and runoff data compiled in this report for the 1968 water year (October 1967 to September 1968) from the urban Waller Creek watershed in Austin, Texas and the rural Wilbarger Creek watershed in Travis County are primarily for comparative purposes in determining the effects of existing and progressive urbanization in the Waller Creek watershed. Also included are average stream discharge values, discharge extremes, and weighted-mean rainfall data for several years of record in both watersheds. (Woodard-USGS)
W71-00041

A STUDY OF STREAM BEHAVIOR IN THE CANTERBURY FOOTHILLS, NEW ZEALAND,
New Zealand Forest Service, Wellington. Forest Service Inst.
Hans M. Keller.
New Zealand Ministry of Works--Water and Soil Division Miscellaneous Hydrological Publication No 3, 1970. 15 p, 7 fig, 7 tab, 14 ref.

Descriptors: *Streamflow, *Stream erosion, *Geomorphology, Drainage patterns (Geologic), Vegetation effects, Geology, Rainfall-runoff relationships, Topography, Alluvial channels, Erosion.
Identifiers: *New Zealand.

The streamflow and geomorphology of a catchment with an area of 7.42 square miles in the Canterbury foothills, New Zealand, was studied. Analyses of topographical maps and aerial photographs were used, as well as field surveys of the stream bed, side slopes, and flow conditions. Hypsometric, intercepting-surface, and stream-profile analyses were adequate to obtain a quantitative measurement of permanent characteristics and, in turn, to allow a direct comparison of the 2 main branches and the 2 subcatchments. Of other surveys and analyses, those of side-slope conditions, detailed sections of longitudinal profile, streamflow comparisons (using conductivity measurements), and vegetational establishment on gravel terraces appeared promising for comparative studies. (Knapp-USGS)
W71-00042

COMPILATION OF HYDROLOGIC DATA, MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Copies of report may be obtained at US Geological Survey, WRD, Federal Bldg, 300 E 8th St, Austin, Texas, 78701. Geological Survey Open-file report, 1970. 9 p, 1 fig.

Descriptors: *Streamflow, *Discharge measurement, *Stream gages, *Texas, Peak discharge, Low flow, Average flow, Rainfall.
Identifiers: *Mountain Creek watershed (Texas).

Compiled in this report are streamflow and reservoir-content data collected in the Mountain Creek watershed, Texas, during the 1968 water year (October 1967 to September 1968). Total outflow from the Mountain Creek basin for the 1968 water year was 106,400 acre-feet. Storage in Mountain Creek Lake increased 130 acre-feet and rainfall during the water year was 36 inches, which is about 2 inches above the long-term mean for the area. Average discharge values and discharge extremes for 8 years of record (1960-68) are given for each of the 4 gaging sites. (Woodard-USGS)
W71-00045

URBAN HYDROLOGY OF THE HOUSTON, TEXAS METROPOLITAN AREA, COMPILATION OF BASIC DATA, 1967,
Geological Survey, Houston, Tex.
S. L. Johnson.
Copies of report may be obtained from US Geological Survey, Water Resources Div, Federal Bldg, 300 E 8th St, Austin, Texas 78701. Geological Survey Open-file report, 1970. 251 p, 15 fig, 22 tab.

Descriptors: *Rainfall, *Runoff, *Texas, Streamflow, Discharge measurement, Stream gages, Storm runoff, Peak discharge, Low flow, Average flow, Hydrographs, Mass curves.
Identifiers: *Urban Hydrology, *Houston (Texas), *San Jacinto River Basin, *Clear Creek Basin.

Compiled in this report are surface-water records for stream-gaging stations and crest-stage partial-record stations, and rainfall records at partial-record stations and miscellaneous sites within the Houston, Texas metropolitan area (San Jacinto River and Clear Creek basins) for the period October 1966 to September 1967. The objectives are to provide basic runoff data for small urban drainage areas which differ in topography, soil, vegetation, tributaries, basin shape, and degree of urbanization; to provide related rainfall data with consideration of variation in intensity and location; and to provide data showing the effects of progressive urbanization on flood peaks and volume. Maps, basic-data tables, and hydrograph and mass curves are included. (Woodard-USGS)
W71-00046

DEVELOPMENT OF WATER RESOURCES IN APPALACHIA - PART I, SUMMARY REPORT.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 06B.
W71-00051

WATER-RESOURCES APPRAISAL OF THE LOWER VIRGIN RIVER VALLEY AREA, NEVADA, ARIZONA, AND UTAH,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02F.
W71-00058

RAINFALL-RUNOFF RELATIONS FOR SOUTHWESTERN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02A.
W71-00059

PEAK FLOW AND CRITICAL DURATION FOR SMALL WATERSHEDS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
C. L. Larson, and R. E. Machmeier.
American Society of Agricultural Engineers Transactions, Vol 11, No 2, p 208-213, 1968. 6 p, 7 fig, 3 tab, 17 ref.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, *Small watersheds, *Peak discharge, Routing, Rational formula, Parametric hydrology, Time lag, Model studies, Unit hydrographs, Computer programs, Duration curves, Runoff forecasting.
Identifiers: Critical duration.

A peak flow equation analytically based and applicable to the channel phase of runoff is presented. The equation is useful in estimating peak discharge for ungaged watersheds up to 100 sq mi or more in area. A new watershed time parameter, time to virtual equilibrium (Tve), is proposed. Both theory and results with a mathematical watershed model indicate that Tve is not constant, but varies as supply rate to a power from - 0.20 to - 0.30. For geometrically similar watersheds, it varies approximately as watershed area to the 0.30 power. A 50-year, duration-supply rate relationship is estimated for the model watershed. Peak discharges are then calculated by the peak-fow formula. Peak discharges are caused by a supply duration much less than time to equilibrium. For the model watershed, peak discharges for a given duration were not proportional to supply rate, as assumed in unit hydrograph analysis. Time parameters, including Tve, time to peak and lag time were not constant but varied with supply rate. Surface runoff is basically nonlinear. (Knapp-USGS)
W71-00061

HYDROLOGIC BASIN, DEATH VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00070

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-00078

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION - 'SSARR' PROGRAM TO THE LOWER MEKONG RIVER,
For primary bibliographic entry see Field 04A.
W71-00080

USE OF CHANNEL SLOPE AND DISCHARGE TO DETERMINE REAERATION COEFFICIENTS FOR THE ELKHORN RIVER IN NEBRASKA,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 05B.
W71-00176

WATER-SURFACE ELEVATIONS AND CHANNEL CHARACTERISTICS FOR SELECTED REACHES OF THE ROGUE RIVER AND ELK CREEK, JACKSON AND JOSEPHINE COUNTIES, OREGON,
Geological Survey, Portland, Oreg.
D. D. Harris.
US Geological Survey Open-file report, 1970. 61 p, 43 fig, 6 tab, 4 ref.

Descriptors: *Floods, *Stage-discharge relations, *Surveys, *Oregon, Water levels, Planning, Zoning, Profiles, Flood plain zoning, Regulation, Gaging stations, Frequency analysis, Channel morphology, Data collections, Hydrologic data.
Identifiers: Rogue River (Oreg).

Water-surface profiles and channel characteristics, geometry and slope, are given for a reach of the Rogue River from the Jackson-Josephine County line, Oregon upstream to Lost Creek damsite and for a reach of Elk Creek from the mouth upstream to Elk Creek damsite. Profiles were defined for the flood of December 1964; the 20-year flood; the 10-year flood; the flood of December 1964 after adjusting for storage in the proposed upstream reservoirs; a low flow considered to be the minimum operational flow from the proposed reservoirs; and the thalweg (the lowest part of the channel bottom). The profile of the adjusted December 1964 flood was determined for the reach of the Rogue River downstream from Dodge Bridge where adjusted discharge data were available. The step-backwater method was used to define the high-water profiles; photogrammetric maps and water-depth soundings made during the periods of low flow ere used to define the low-water and thalweg profiles. (Knapp-USGS)
W71-00190

MAXIMUM KNOWN STAGES AND DISCHARGES OF NEW YORK STREAMS THROUGH 1967,
Geological Survey, Albany, N.Y.
Bernard Dunn.
New York Water Resources Commission Bulletin 67, 1970. 57 p, 1 tab.

Descriptors: *Stage-discharge relations, Discharge (Water), *Peak discharge, *New York, Data collections, Runoff, Streamflow, Hydrologic data, Stream gages.
Identifiers: Streamflow data.

Maximum stages and discharges in New York streams are compiled from the files of the U.S. Geological Survey. The data are tabulated under the heading of the major river or lake basin in which the stream is located. The period of record begins with the first calendar year and ends with the last calendar year for which a peak discharge is known. In most cases there are also peaks for each of the intervening years. (Knapp-USGS)
W71-00191

A PROPOSED STREAMFLOW DATA PROGRAM FOR MICHIGAN,
Geological Survey, Lansing, Mich.
Paul C. Bent.
Geological Survey Open-file report, 1970. 69 p, 5 fig, 8 tab, 8 ref, 1 append.

Descriptors: *Streamflow, *Data collections, *Synoptic analysis, *Project planning, Programs, Regression analysis, Runoff, Precipitation (Atmospheric).
Identifiers: Proposed streamflow-data program, Streamflow characteristics, Drainage basin characteristics, Natural-flow streams, Regulated-flow streams.

An evaluation of the streamflow data available in Michigan was made to provide guidelines for planning future water resource programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives. It was found that most goals could not be met by regionalization of the data for gaged basins by regression analysis. This fact indicates that few changes can be made in the present program on the basis of computing data by regression formulas. However, regression formulas that include factors not evaluated as a part of this study, may provide a basis for regional streamflow analysis. The evaluation indicated that some changes in the streamgaging network can be made on the basis of length of records already collected. A streamflow data program based on the guidelines developed in this study is proposed for the future. (Woodard-USGS)
W71-00199

COMPILATION OF HYDROLOGIC DATA, COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.

Geological Survey Open-file report, 1970. 80 p, 3 fig, 3 tab.

Descriptors: *Rainfall, *Runoff, *Storage, *Texas, Streamflow, Discharge measurement, Stream gages, Storm runoff, Peak discharge, Low flow, Average flow, Hydrographs, Mass curves.
Identifiers: *Brazos River Basin (Texas), Weighted-precipitation record, Inflow and outflow computations.

This report contains rainfall, runoff, and storage data collected during the 1968 water year (October 1967 to September 1968) for the 79.6 square-mile area above stream-gaging station Cow Bayou at Mooreville, Brazos River Basin, Texas. Monthly and yearly rainfall, runoff, and storage data from 1957 to 1968 are included. The location of flood-water-retarding structures and hydrologic instruments in the area are shown. Current objectives of the study are to determine the net effect of flood-retarding structures on the regimen of streamflow at downstream points; to develop computation techniques that will provide more accurate estimates of runoff resulting from a given amount of rainfall on small watersheds; to develop relationships between maximum rates of runoff and rainfall in small watersheds that will enable more accurate design of small storm-drainage structures; and to determine the minimum instrumentation necessary to make reliable estimates of total storm inflow to the structures. (Woodard-USGS)
W71-00216

INFLUENCE OF LAND USE ON RUNOFF FROM AGRICULTURAL WATERSHEDS,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 04C.
W71-00218

WATER RESOURCES OF THE GUAYANILLA-YAUCO AREA, PUERTO RICO,
Geological Survey, San Juan, Puerto Rico.
James W. Crooks, I. G. Grossman, and Dean B. Bogart.
Commonwealth of Puerto Rico Water-Resources Bulletin 5, 1968. 55 p, 27 fig, 12 tab, 10 ref.

Descriptors: *Water resources development, *Puerto Rico, Surface waters, Groundwater, Water supply, Data collections, Hydrologic data, Hydrogeology, Conjunctive use, Water wells, Aquifers, Saline water intrusion.
Identifiers: Guayanilla-Yauco area (Puerto Rico).

More water is available for use than was being used in 1961 in the Guayanilla-Yauco area, which comprises the lower part of the basins of Rio Yauco, Rio Guayannilla, and Rio Macana, an area of about 33 sq mi in northwestern Puerto Rico. Water use in 1961 was about 37,000 ac-ft (acre-feet), a little more than half of which was groundwater. Of the quantity used, about 85% was for irrigation. About 43,000 ac-ft of streamflow enters the Guayanilla-Yauco area annually, on the average, much of which is lost to the sea during floods. In addition, rainfall on the area averages about 67,000 ac-ft, making a total input to the area of about 110,000 ac-ft. In the drier-than-average year of 1962, the total input was about 79,000 ac-ft. The easiest and least costly way to obtain more water on a year-round basis is by means of wells. Up to 30 mgd water can be obtained if a comprehensive system of facilities and management is developed. This system would include surface reservoirs if adequate sites can be located for storage of flood waters now largely wasted to the sea. The water is hard, but it is suitable for municipal use and for many industrial purposes with simple treatment. Most of the water is suitable for irrigation without treatment. The water in a narrow zone along the coast is brackish, but no data to date indicate active salt-water encroachment. (Knapp-USGS)
W71-00228

FLOODS OF MARCH-MAY 1965 IN THE UPPER MISSISSIPPI RIVER BASIN,
Geological Survey, Washington, D.C.
D. B. Anderson, and I. L. Burmeister.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC - Price $2.25. Geological Survey Water-Supply Paper 1850-A, 1970. 448 p, 50 fig, 9 tab, 13 ref.

Descriptors: *Floods, *Flood damage, *Streamflow, Peak discharge, Meteorological data, Climatic data, Gaging stations, Flood plains, Flood forecasting.
Identifiers: Recurrence intervals, Drainage and storage effects.

The floods of March-May 1965 in the upper Mississippi River basin occurred as two different events, one during the latter part of February and early March and the other starting early in April and extending into May. Factors contributing to the floods were rapid melting of the winter accumulation of snow, heavy rains on the snow pack, and deeply frozen ground throughout much of the basin, which made the soil almost impervious and thereby greatly increased the amount of runoff. Peak stages and discharges during the floods exceeded previous known maxima at many points. Included in this report are peak stages and discharges for these floods at 333 sites; the previous maxima at these sites where such data are available; the recurrence interval for many sites; flood damages; effect of drainage and storage on flood peaks; and the operations of the U. S. Geological Survey and other Federal agencies during the flood emergency. (Woodard-USGS)
W71-00304

HYDRAULICS OF BRIDGE WATERWAYS.
Bureau of Public Roads, Washington, D.C. Bridge Div.
For primary bibliographic entry see Field 08B.
W71-00350

WATER-SURFACE ELEVATIONS AND CHANNEL CHARACTERISTICS FOR A SELECTED REACH OF THE APPLEGATE RIVER, JACKSON COUNTY, OREGON,
Geological Survey, Portland, Oreg.
D. D. Harris, and C. W. Alexander.
Geological Survey Open-file report, 1970. 42 p, 30 fig, 4 tab, 5 ref.

Descriptors: *Profiles, *Floods, *Stage-discharge relations, *Oregon, Mapping, Flood forecasting, Streamflow forecasting, Hydrologic data, Data collections, Water levels, Channel morphology, Planning, Flood plains, Flood protection, Flood control, Reservoirs.
Identifiers: Applegate River (Oreg).

Flood and low-water elevations for a selected reach of the Applegate River, Oregon from the Jackson-Josephine County line to the Applegate damsite are presented in tables and graphical profiles. Elevations for a discharge on the Applegate River equivalent to that of the flood in December 1964, but reduced by storage in the proposed Applegate Reservoir, would fall between 10- and 20-year flood elevations downstream from Beaver Creek (river mile 40.6). Upstream from Beaver Creek, the adjusted December 1964 flood would be lower than a 10-year flood. The computed water-surface profiles are generally in good agreement with the documental flood elevations. (Knapp-USGS)
W71-00353

DEVELOPMENT OF A RESISTANCE-WIRE WAVE GAUGE FOR SHALLOW-WATER WAVE AND WATER-LEVEL INVESTIGATIONS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 07B.
W71-00357

A NEW 'BASELESS' PROPORTIONAL WEIR,
Indian Inst. of Science, Bangalore (India). Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 07B.
W71-00359

JOINT PROBABILITY METHOD OF TIDE FREQUENCY ANALYSIS APPLIED TO ATLANTIC CITY AND LONG BEACH ISLAND, N. J.,
Weather Bureau, Silver Spring, Md.
For primary bibliographic entry see Field 04A.
W71-00378

METEOROLOGICAL ASPECTS OF HURRICANE CAMILLE--AUGUST 14-22, 1969,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02B.
W71-00382

HYDRAULIC JUMP WITHIN A GRADUALLY EXPANDING CHANNEL,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 08B.
W71-00383

FLOOD HYDROLOGY OF SMALL WATERSHEDS: EVALUATION OF TIME PARAMETERS AND DETERMINATION OF PEAK DISCHARGE,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
I-pai Wu.
American Society of Agricultural Engineers Transactions, Vol 12, No 5, p 655-660, 663, September-October 1969. 7 p, 11 fig, 1 tab, 19 ref. OWRR Project B-006-HI.

Descriptors: *Floods, *Hydrology, *Small watersheds, *Rainfall-runoff relationships, *Hawaii, Peak discharge, Time, Rainfall, Runoff, Streamflow, Gaging stations, Hydrographs, Equations, Parametric hydrology, Frequency analysis, Runoff forecasting, Depth-area-duration analysis, Rainfall intensity.

This paper is based on the evaluation of more than 250 hydrographs from about 30 small watersheds on the island of Oahu. The existing drainage-design criteria for the Hawaiian Islands are arbitrarily set in two groups: the rational formula is used for areas less than 100 acres where the coefficient C is revised from mainland standards. Frequency analysis or envelope curves based on maximum experience are used for watersheds larger than 100 acres. A frequency analysis for annual peak discharge was made for 23 watersheds (island of Oahu) and peak discharge of 100-year, 24-hr precipitation for the determination of peak discharge for ungaged areas. The relationship between peak discharge and runoff appears to be linear for a given watershed regardless of intensity, duration and size of the storm. The time to peak which varies slightly from different hydrographs will not change the general shape of the hydrograph or the linearity of the peak discharge and runoff relation. However, this linear relation cannot be extended beyond 6 inches of runoff. Graphs, equations, tables of data, and a map locating gaging stations are included. (Woodward-USGS)
W71-00403

ENERGY DISSIPATION IN OPEN CHANNELS BY LARGE SEMI-CIRCULAR DISK ROUGHNESS ELEMENTS,
Asian Inst. of Tech., Bangkok (Thailand).
For primary bibliographic entry see Field 08B.
W71-00406

DELAWARE RIVER MODEL STUDY, REPORT NO 1. HYDRAULIC AND SALINITY VERIFICATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-00443

STREAMFLOW CHARACTERISTICS OF THE NORTHEASTERN UNITED STATES,
Pennsylvania Agricultural Experiment Station, University Park.
William E. Sopper, and Howard W. Lull.
Available from NTIS as PB-192 878, $3.00 in paper copy, $0.95 in microfiche. Bulletin 766, June 1970. 141 p.
Identifiers: *Forestry, Management planning, *Rivers, United States, *Hydrology, Reviews, Periodic variations, Meteorological parameters, Fluid flow, Volume, *Streamflow characteristics, Watersheds, Northeastern United States, Seasonal runoff.

Forest watershed management research was intiated in Northeastern United States in 1948 and is continuing on 29 small, forested experimental watersheds located in New Hampshire, New Jersey, Pennsylvania, Maryland, and West Virginia. One of the common objectives of these research programs is to determine the effect of the forest cover and forest management practices on streamflow, specifically, the quantity of water yield and its time distribution, and water quality. Four studies were conducted. The first was to determine average annual and seasonal water yields, flow duration, and high daily flows for 137 watersheds and to relate these, insofar as possible, to the seven major physiographic regions in the Northeast. In the second study, the relationships of average anual and seasonal discharges, flow-duration discharges, and high daily flow discharges to selected climatic, geographic, topographic, and land-use variables were investigated. This analysis was extended in the third study to better define the relationships between the water yield parameters and the climatic and physical watershed variables within each of the physiographic regions. The fourth study was concerned primarily with the determination of the representativeness of the small experimental watersheds in relation to the physiographic region in which they are located.
W71-00464

HYDRAULIC GEOMETRY OF 12 SELECTED STREAM SYSTEMS OF THE UNITED STATES,
Illinois State Water Survey, Urbana.
John B. Stall.
Available from NTIS as PB-195 165, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 32, July 1970. 73 p, 25 tab, 28 fig, 32 ref, append. OWRR Project B-023-ILL (1).

Descriptors: *Channels, *Hydraulics, *Streams, *Flow, Open channel flow, Streamflow, Runoff.
Identifiers: *Re-oxygenation, Hydraulic geometry.

A completed project shows there to be, for the 18 river basins in Illinois, a consistent pattern in which the width, depth, and velocity of flow in a stream change along the course of the stream, with a constant frequency of discharge. These channel characteristics are termed hydraulic geometry and constitute and interdependent system which can be described by a series of graphs having simple form or by equations. The data from about 250 stream gaging stations will be assembled and used to develop the parameters to define the hydraulic geometry of stream systems for ten river basins selected to represent various physiographic and hydrologic regions of the humid part of the United States. These parameters are to be generalized for various physiographic divisions and used to help explain variability of other observed hydrologic phenomena such as low flow frequency, and flow-duration. These parameters will also be used to predict the average depth and velocity of flow at problem locations on the stream where no measurements are available. This will allow computation of the re-oxygenation capacity of the stream at a problem location, and the time-of-travel of contaminants through the stream system.
W71-00472

SIMULATION OF CONTINUOUS DISCHARGE AND STAGE HYDROGRAPHS IN THE NORTH BRANCH OF THE CHICAGO RIVER.
Hydrocomp International, Inc., Palo Alto, Calif.

Report to Northeastern Illinois Planning Commission, Chicago, Illinois, 1970. 56 p, 14 fig, 13 tab.

Descriptors: *Simulation analysis, *Streamflow forecasting, *Streamflow, *Hydrographs, *Mathematical models, *Urbanization, *River forecasting, *Flood forecasting, *Flood control, *Flood plains, *Model studies, *Watershed management, *Stage-discharge relations, *Illinois, Flow, Surface runoff, Computer models, Channel improvements, Planning, Watersheds.
Identifiers: *Chicago River.

The report summarizes streamflow simulation studies of the North Branch of the Chicago River using mathematic modeling techniques. The Northeastern Illinois Planning Commission had the studies made to aid: (1) the development of regional maps delimiting flood plains for 25, 50 and 100 year frequencies, based upon present physiographic conditions and continued urbanization; (2) evaluation of the hydrologic impact of flood control works, channel constrictions, and changes in urban development patterns. These objectives are essential for intelligent land use planning, and are required in the National Flood Insurance Program. The stream studied flows into and through the Chicago metropolitan area and is typical of watersheds in Northeastern Illinois. It has a flat stream channel gradient and broad flood plains at high discharge. Simulation studies showed that steps must be taken either to preserve the stream's perogative to flow over its flood plain, or substantially alter the stream channels as they now exist. If flood plain storage is taken for a subdivision at one point, it could be returned to the stream at another point by land purchase and excavations. Alternately, if channel storage is not preserved, large floodways, detention basins or underground caverns will be needed. Results of simulation studies of flood discharge and stage are presented by tables and graphs. (Poertner)
W71-00483

GOODWIN V TEXAS CO (LIABILITY FOR DAMAGES FOR SEEPAGE OF COLLECTED WATER AND OBSTRUCTION OF WATERCOURSE).
For primary bibliographic entry see Field 06E.
W71-00512

2F. Groundwater

GROUNDWATER BASIC DATA, ORANGE AND ULSTER COUNTIES, NEW YORK,
Geological Survey, Albany, N.Y.
Michael H. Frimpter.
New York Water Resources Commission Bulletin 65, 1970. 93 p, 1 fig, 2 plate, 3 tab.

Descriptors: *Water wells, *New York, *Data collections, *Hydrologic data, Hydrogeology, Aquifers, Groundwater, Water resources.
Identifiers: Ulster County (NY), Orange County (NY).

Basic groundwater data useful in planning and studying the development of groundwater in Orange and Ulster Counties, N.Y., are tabulated. The records of 1,660 wells and springs are reported. Graphic lithologic logs of 497 wells and test borings and the results of 128 chemical analyses of well water are presented. (Knapp-USGS)
W71-00003

GROUNDWATER CONDITIONS IN UTAH, SPRING OF 1970,
Geological Survey, Salt Lake City, Utah.
C. T. Sumsion, L. J. Bjorklund, E. L. Bolke, R. W. Mower, and L. R. Herbert.
Utah Division Water Resources Cooperative Investigations Report No 8, 1970. 71 p, 36 fig, 2 tab, 7 ref.

Descriptors: *Hydrologic data, *Groundwater, *Water levels, *Utah, Hydrogeology, Water resources, Water resources development, Irrigation water, Water wells, Water level fluctuations, Recharge, Water yield, Water quality, Data collections.
Identifiers: Groundwater levels.

This report contains information on well construction, groundwater withdrawals, water-level changes, and related changes in precipitation and streamflow in Utah. It also contains supplementary data that are related to groundwater use in some areas. Less than 2% of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows, limestone, and sandstone. More than 98% of the wells in Utah draw water from unconsolidated rocks. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains. The estimated total withdrawal of water from wells in Utah during 1969 was about 670,000 acre-feet, about 40,000 acre-feet more than that reported for 1968. Precipitation during most of the growing season was less than normal in parts of the State where the largest withdrawals are for irrigation, so irrigation withdrawals increased in these areas. Although all types of groundwater withdrawals except public supply increased, water levels generally rose throughout the State from March 1969 to March 1970 as a result of above-normal precipitation. Groundwater development and changes in groundwater conditions in the major areas of groundwater development are summarized. (Knapp-USGS)
W71-00004

THEORY OF FLOW TO DRAINS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Jan Van Schilfgaarde.
In: Advances in Hydroscience, Vol 6, New York, N.Y., Academic Press, p 43-106, 1970. 64 p, 18 fig, 82 ref.

Descriptors: *Reviews, *Drainage systems, *Soil water movement, *Groundwater movement, Saturated flow, Unsaturated flow, Steady flow, Unsteady flow, Darcys law, Dupuit-Forchheimer theory, Water levels, Salinity, Water level fluctuations, Recharge, Discharge (Water), Hydraulic conductivity.
Identifiers: Flow to drains.

The basic principles on which the theory of fluid flow is based, developments from these principles as they apply to drainage, and their application to practical design problems are reviewed. In humid areas, the primary functions of drainage systems are: to provide an environment favorable for plant roots, and a soil-physical condition conducive to economic farming operations. In irrigated regions, the primary function is to establish or maintain a favorable salt balance in the soil. The engineer needs to know the physical properties of the soil before he can design the drainage system. Of primary concern are reliable estimates of hydraulic conductivity, depth of the water-conducting layer and pore space distribution. Flow theory permits the determination of water table heights. In principle, this approach enables the derivation of design criteria and economic evaluation. It also provides the framework for study of the response of crop plants to drainage. The review includes the Navier-Stokes and Darcy equations of motion, equations for saturated flow, and equations for unsaturated flow. Both steady and unsteady flows are discussed. Methods and theory for soil-property measurements are reviewed. Applications of theory and techniques to drainage design are outlined. (Knapp-USGS)
W71-00007

TWO-LIQUID FLOWS IN POROUS MEDIA,
Technion - Israel Inst. of Tech., Haifa.
Jacob Bear.
In: Advances in Hydroscience, Vol 6, New York, N Y, Academic Press, p 141-252, 1970. 112 p, 53 fig, 72 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Reviews, *Interfaces, Saline water-freshwater interfaces, Saline water intrusion, Stratified flow, Oil-water interfaces, Air-water interfaces, Porous media, Flow, Diffusion, Dispersion, Mixing, Aquifers.
Identifiers: Two-liquid flow.

Some basic concepts, techniques and methods of investigation of problems involving the flow of two fluids through a porous medium are reviewed. Such problems are often encountered in groundwater hydrology and (oil) reservoir engineering. Miscible displacement or hydrodynamic dispersion is a type of two-fluid flow in which the two fluids are completely soluble in each other. A distinct fluid-fluid interface does not exist. Immiscible displacement is the simultaneous flows of two or more immiscible fluids. A distinct fluid-fluid interface separates the two fluids within each pore. In many cases of interest, the transition zone in the case of miscible fluids is relatively narrow so that for all practical purposes a fictitious abrupt interface separates the two fluids. On each side of this imaginary interface is a single phase only. This assumption appreciably simplifies the treatment of the two-fluid problem. Across the mixing zone between sea water and fresh water in coastal aquifers the density of the water varies gradually from that of fresh water to that of sea water. Artificial recharge also introduces one quality of water into an aquifer containing water of another quality. Unsaturated flow is the flow of water and water vapor through a soil in which the void space is partly filled with air. Essentially, this is a case of simultaneous flow of two immiscible fluids (water and air) except that often the assumption is made that the air is practically immobile. (Knapp-USGS)
W71-00009

UNSTEADY SEEPAGE TOWARD NARROW DITCH,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-00021

EFFECTS OF GROUNDWATER SEEPAGE ON FLUVIAL PROCESSES,
Wisconsin State Univ., Oshkosh. Dept. of Geology; and North Dakota Univ., Grand Forks. Dept. of Geology.
Samuel S. Harrison, and Lee Clayton.
Geological Society of America Bulletin, Vol 81, No 4, p 1217-1225, April 1970. 9 p, 6 fig, 9 ref. NSF Grant 4424.

Descriptors: *Sediment transport, *Surface-groundwater relationships, *Seepage, *Stream erosion, Permeability, Channel morphology, Roughness (Hydraulic), Mud, Sands, Sediments, Discharge (Water).
Identifiers: Stream competence.

Field observations of a small stream have indicated that seepage of water into or out of a stream may greatly alter stream competence. Theoretically, water seeping through the stream bed exerts a drag on quartz grains that changes stream competence by the factor 1.65/ (1.65-i) where i is the seepage gradient. Experiments in laboratory flumes, however, indicate that seepage through a stream bed, despite its effect on effective grain density, causes no change in competence in gaining streams nor in losing streams that lack a mud seal. Possibly the expected change in competence is partially counteracted by the accompanying changes in form drag and surface drag on the grains. Flume experiments also show that upward seepage reduces the steepness of bed forms and decreases bed roughness, whereas downward seepage steepens

the bed forms and increases bed roughness, but these changes appear to be insufficient to cause any measurable change in the slope of the water surface. Downward seepage in the presence of sufficient suspended sediment, however, can lead to the formation of a mud seal on the surface of a stream bed; this results in a great increase of the effective density of the bed sediment and may result in the total elimination of sediment entrainment from the bed. (Knapp-USGS)
W71-00028

COMPARATIVE HYDROGEOLOGY: AN EXAMPLE OF ITS USE,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02A.
W71-00029

REGIONAL GROUNDWATER FLOW BETWEEN LAKE SIMCOE AND LAKE ONTARIO,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
C. J. Haefeli.
Canada Department Energy, Mines and Resources, Inland Waters Branch Technical Bulletin No 23, 1970. 42 p, 25 fig, 2 plate, 51 ref.

Descriptors: *Hydrogeology, *Groundwater movement, *Surface-groundwater relationships, *Lake Ontario, Water levels, Groundwater basins, Surveys, Aquifers, Glacial drift, Water chemistry, Water wells, Data collections.
Identifiers: Regional groundwater flow, Lake Simcoe (Ontario), Canada.

Lake Simcoe is 35 to 40 miles north of and about 470 feet higher than Lake Ontario. However, the average elevation of the Lake Simcoe Basin is only about 250 feet higher. The surface water divide within the study area of 600 square miles lies mainly between elevations 900 and 1100 feet. The relatively high elevation of the Lake Simcoe Basin, the south dipping surface and bedding of the bedrock, and especially the north-south directed, deep bedrock channels point to the possible existence of a southbound groundwater flow system. The thickness of the quaternary deposits varies considerably between Lake Ontario and Lake Simcoe. From less than 50 feet at the south-eastern shore of Lake Simcoe, the drift increases to over 400 feet in the area between Newmarket and Richmond Hill. From there, it begins to decrease southwards, becoming 25 to 75 feet thick along Lake Ontario's shoreline south and west of Toronto. Regional, extensive, well defined aquifers do not exist. The general pattern of the quaternary deposits is a body of very low permeability with enclosed high permeable lenses of various sizes. The highest transmissibility values for the most productive aquifer lenses range approximately from 40,000 to 80,000 Igpd/ft which suggests that good aquifers do exist although they may be difficult to define. Most of the pumping tests show impermeable boundary conditions. The configuration of the water table corresponds generally with the topography. Piezometric, hydrogeochemical and mathematical analyses demonstrate the non-existence of major seepage from Lake Simcoe into the Lake Ontario basin. The groundwater divide coincides approximately with the basin boundary in the quaternary deposits as well as in the different underlying bedrock formations. (Knapp-USGS)
W71-00031

ELECTRIC ANALOG MODEL EVALUATION OF A WATER-SALVAGE PLAN, SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00034

RESULTS OF TEST DRILLING AT THE CENTRAL GREAT PLAINS FIELD STATION NEAR AKRON, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
Warren E. Hofstra.
Geological Survey Open-file report, June 1970. 26 p, 4 fig, 2 tab, 3 ref.

Descriptors: *Hydrologic data, *Aquifers, *Colorado, *Sampling, *Water wells, Water levels, Boreholes, Stratigraphy, Hydrogeology, Water resources, Water resources development, Maps, Cross-sections.
Identifiers: Central Great Plains Field Station (Colo).

The U. S. Geological Survey collected geologic, hydrologic and geophysical information from 16 test holes drilled at the Central Great Plains Field Station, Colorado during the period June 5 to July 3, 1969. The Field Station is located about 4 miles east of Akron, Washington County, Colo. The work was done at the request of the U. S. Department of Agriculture to obtain information on lithologic variations in the Ogallala Formation of Pliocene age. Observation wells were installed in the test holes to monitor the movement of water. This report presents the basic data collected during the test-drilling program, and a water-table contour map, a bedrock contour map, and a generalized section. Results of the test drilling, a lithologic description, and moisture content of cores are given in the tables. The geophysical logs are on file in the Colorado District Office, Water Resources Division, U. S. Geological Survey, Denver, Colo. and at the Central Great Plains Field Station, Akron, Colo. (Knapp-USGS)
W71-00037

GROUNDWATER RESOURCES OF THE LOWER HILLSBORO CANAL AREA, SOUTHEASTERN FLORIDA,
Geological Survey, Tallahassee, Fla.
H. J. McCoy, and Jack Hardee.
Florida Bureau of Geology Report of Investigation No 55, 1970. 44 p, 21 fig, 3 tab, 14 ref.

Descriptors: *Water resources, *Groundwater, *Hydrogeology, *Florida, Aquifers, Saline water intrusion, Water yield, Water quality, Transmissivity, Monitoring, Data collections, Hydrologic data, Water resources development, Urbanization.
Identifiers: Hillsboro Canal Area (Fla).

The lower Hillsboro Canal area occupies about 60 square miles of Palm Beach and Broward counties in southeastern Florida. All potable groundwater is obtained from the Biscayne aquifer. The aquifer extends from the land surface to a depth of about 400 feet and is composed of sand, sandy limestone, shells, and indurated calcareous sand. Municipal well fields of Deerfield Beach and Boca Raton and most of the domestic, irrigation, and industrial wells obtain adequate water supplies from permeable limestone 90 to 130 feet below land surface. Rainfall in the area and induced infiltration from controlled canals provide the recharge to the aquifer. Sea-water intrusion, although a constant threat, has not advanced inland enough to contaminate either municipal well field. Data collection stations are maintained to monitor changes of the salt-water front in the aquifer. Large quantitites of water can be withdrawn from the interior part of the area without the threat of salt-water intrusion. (Knapp-USGS)
W71-00039

HYDROGEOLOGIC DATA FOR THE LOWER ARKANSAS RIVER VALLEY, COLORADO,
Geological Survey, Denver, Colo.
Thomas J. Major, R. Theodore Hurr, and John E. Moore.
Colorado Water Conservation Board Groundwater Series Basic Data Report No 21, 1970. 125 p, 5 fig, 4 plate, 7 tab, 15 ref, append.

Descriptors: *Hydrologic data, *Groundwater, *Colorado, *Water levels, Hydrogeology, Water level fluctuations, Irrigation, Irrigation water, Water utilization, Data collections, Water resources development, Hydrographs, Water yield.
Identifiers: Arkansas River Valley (Colo).

Groundwater use as a supplemental irrigation supply in the Arkansas River valley increased substantially between 1950 and 1965. During this 15-year period about 1,000 wells were drilled. Withdrawal of groundwater by wells increased from 31,000 to 185,000 acre-feet annually in this period. The annual average withdrawal was 65,400 acre-feet for the first 5 years and 144,000 acre-feet for the last 5 years. This report presents the basic data collected during the inventory of the water resources of the reach of the valley from Pueblo to the Kansas State line. It includes maps showing the location of large-capacity irrigation, public supply, and industrial wells, records of well construction and yield, chemical analyses of groundwater, water-level measurements, and well logs. Records of 1,348 irrigation wells and 119 public supply and industrial wells are included. (Knapp-USGS)
W71-00047

GEOLOGIC MAP OF THE LOWER CACHE LA POUDRE RIVER BASIN, NORTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
Lloyd A. Hershey, and Paul A. Schneider, Jr.
Geological Survey Open-file report, May 1970. 1 map.

Descriptors: *Maps, *Geologic mapping, *Colorado, Hydrogeology, Hydrologic data, Stratigraphy, Geological surveys, Aquifers, Water yield.
Identifiers: Cache La Poudre River basin (Colo).

A geologic map of the Lower Cache La Poudre River basin of north-central Colorado includes descriptions of water yield to wells with the lithologic descriptions of the formations mapped. The rocks of the area range in age from Precambrian to Holocene and include gneisses, conglomerates, shales, sandstones, limestones, and unconsolidated alluvium and colluvium, all of which (except the shales) yield water. (Knapp-USGS)
W71-00049

GROUNDWATER RESOURCES -- APPENDIX H TO REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA,
Geological Survey, Washington, D.C.
Granville A. Wyrick, and Orville, B. Lloyd, Jr.
Report on Development of Water Resources in Appalachia published in 25 volumes. Geological Survey Cooperative Report, Vol 23 of 25 Vol, Append H, 1968. 122 p, 23 fig, 2 tab, 83 ref.

Descriptors: *Water resources development, *Groundwater, *Appalachian Mountain region, Water supply, Water costs, Optimum development plans, Economic justification, Project planning, River basin development, Water yield, Water quality, Hydrogeology, Geology.
Identifiers: Appalachian redevelopment.

This Appendix, 'Ground Water', provides figures on the amount of available groundwater and the costs of developing groundwater supplies in Appalachia. The relative availability and occurrence of groundwater and the relative cost and optimum development of groundwater supplies are described for the Region as a whole. Groundwater information is presented for specific sites which have been selected for study by the Corps of Engineers because of obvious needs for local water supplies to stimulate local economic growth. (See also W71-00051) (Knapp-USGS)
W71-00052

A STUDY IN THE GROUNDWATER HYDROLOGY OF THE MEERUT DISTRICT, UTTAR PRADESH, INDIA,
Banaras Hindu Univ., Varanasi (India). Dept. of Geography.
R. N. Mathur.
Varanasi, India, Banaras Hindu University, 1969. 109 p, 34 fig, 11 tab, 268 ref.

Descriptors: *Water resources development, *Groundwater, *Hydrologic budget, Groundwater basins, Water yield, Aquifers, Alluvium, Transmissivity, Water levels, Climates, Topography, Surveys, Water utilization, Irrigation water.
Identifiers: *India, Uttar Pradesh (India), Ganga Plain (India).

A study of the groundwater hydrology of the Meerut district in the Ganga Plain in Uttar Pradesh, India includes descriptions of climate, physiography, and geology, as well as hydrogeology. This is the first such hydrogeologic study ever made in India. An important part of the analysis is a calculation of the hydrologic budget of the area. The Ganga Plain area is being exploited for groundwater on a very large scale; the irrigation project is probably the largest in the world. The plain is a continuous and conformable series of alluvial deposits, composed of unconsolidated sand, clay, gravel and their mixtures. The older alluvium is Middle Pleistocene whereas the younger gradually passes into the Recent. Coarse sand beds, either alone or with consolidated sand, gravel or pebble beds, generally occur at relatively greater depths; whereas clay beds predominate at shallower depths. An aggregate thickness of about 100 feet of good water-bearing strata are generally present in an average depth of 300 feet. Withdrawals of more than 350 acre-feet per square mile may result in a permanent lowering of the water table and in increasing pumping costs. The present spacing of about 2 square miles per tube-well can be somewhat reduced because the area of influence per well amounts to 1 square mile. (Knapp-USGS)
W71-00057

WATER-RESOURCES APPRAISAL OF THE LOWER VIRGIN RIVER VALLEY AREA, NEVADA, ARIZONA, AND UTAH,
Geological Survey, Carson City, Nev.
Patrick A. Glancy, and A. S. Van Denburgh.
Nevada Division of Water Resources, Water Resources-Reconnaissance Series Report 51, 1969. 87 p, 4 fig, 2 plate, 2 photo, 22 tab, 52 ref.

Descriptors: *Water resources, *Surveys, *Nevada, Surface waters, Groundwater, Streamflow, Water yield, Aquifers, Water supply, Water resources development, Data collections, Hydrologic data, Hydrogeology, Water quality, Evapotranspiration.
Identifiers: Virgin River Valley (Nev).

A water-resources reconnaissance was made of the lower Virgin River Valley, Tule Desert, and Escalante Desert basin in Nevada. THE LOWER Virgin River Valley comprises the river flood plain and its tributary drainages from The Narrows, about 5 miles east of Littlefield, Arizona, downstream to the river's confluence with Lake Mead. The lower Virgin River is the dominant hydrologic feature of the area. Water contributed to the river's floodplain area includes direct precipitation, river inflow, and groundwater underflow, plus surface-and groundwater inflow from tributary drainages within the report area. Outflow includes streamflow and groundwater underflow to Lake Mead, consumptive use, and natural evapotranspiration. Most consumptive use is for irrigation of crops by diversion of surface flow. Only a small amount of groundwater is pumped for irrigation, but groundwater reservoirs furnish most of the municipal, domestic, and livestock supply. Water in the Virgin River usually contains 1,000-3,000 mg/l of dissolved solids--largely calcium, sodium, sulfate, and chloride. Groundwater along the river characteristically is very hard, and contains 500 to as much as 5,000 mg/l of dissolved solids, dominated by sulfate and sodium or calcium. (Knapp-USGS)
W71-00058

WATER-LEVEL RECORDS FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Denver, Colo.
Arnold J. Boettcher, Warren E. Hofstra, and Thomas J. Major.
Colorado Water Conservation Board Groundwater Series Basic-Data Release No 20, 1969. 189 p, 4 fig, 3 plate, 1 tab.

Descriptors: *Hydrologic data, *Colorado, *Water levels, *Water level fluctuations, *Water wells, Irrigation wells, Alluvium, Aquifers, Withdrawal, Data collections, Sampling, Water resources, Water yield, Hydrographs.
Identifiers: High Plains (Colorado), Ogallala formation.

The northern High Plains of Colorado is bounded by the State line on the east, the South Platte River on the north, the Arkansas River on the south, and extends west to Limon, Colo. Irrigation supplies are derived almost entirely from wells tapping the Ogallala Formation. The semiconsolidated Ogallala consists of sand, gravel, silt, and clay, and ranges in thickness from a few feet on the west to as much as 400 feet in places near the State line. Groundwater withdrawals in the area nearly quadrupled between 1960 and 1968 as the number of irrigation wells increased. In 1960 there were 480 wells and in 1968 there were 1,810 wells. Utilization of the resources at this rate has caused significant water-level declines in areas where wells are concentrated. This report presents water-level records collected by personnel of the U. S. Geological Survey and Colorado State University. A large part of this report was compiled by automatic storage and retrieval methods. Water-level measurements for each well were punched on cards and printed by a computer. In January 1964, the number of observation wells was increased from 52 to 400 to provide a better sampling of water-level changes. Measurements in the 400 observation wells also were made in 1966, and 1969, and will be made annually in the future. (Knapp-USGS)
W71-00060

HYDROLOGIC BASIN, DEATH VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
Charles B. Hunt, T. W. Robinson, Walter A. Bowles, and A. L. Washburn.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402. US Geological Survey Professional Paper 494-B, 1966. 138 p, 73 fig, 3 plate, 53 tab, 139 ref.

Descriptors: *Groundwater basins, *California, *Deserts, Arid lands, Saline water systems, Brines, Sedimentation, Chemical precipitation, Hydrology, Hydrogeology, Groundwater movement, Stratigraphy, Geology, Evaporation.
Identifiers: Death Valley (Calif).

The Death Valley hydrologic basin covers about 8,700 square miles, of which about 500 square miles is below sea level. The bottom of the basin--the saltpan in Death Valley, one of the world's great saltpans--covers more than 200 square miles and lies as much as 282 feet below sea level. Death Valley is the hottest and driest part of the United States. Temperatures greater than 120 deg F are common during the summer, and a maximum of 134 deg F has been recorded. Annual rainfall in the valley averages about 1.66 inches; the average precipitation in the entire hydrologic basin probably is about 4-5 inches. The evaporation rate in Death Valley is about 150 inches per year. In the central part of Death Valley, salt deposits form a crust covering most of 200 square miles, about 10 percent of the hydrologic basin. Most of the distinctive hydrologic features of the basin are directly the result of the structural geology. Groundwater is ponded in the structural basins, and it moves from one basin to another along faults that extend through topographic divides. Groundwater also enters the basin along faults from neighboring basins. The thickness of the salt crust on the saltpan ranges from a few inches to a few feet. Under the crust is silt and clay. At the center of the pan, the salts in the crust and the brines are mostly chlorides. These chlorides are surrounded by a narrow zone in which the salts are chiefly sulfates; these sulfates, in turn, are surrounded by a sandy zone containing carbonate salts and forming the edges of the pan. This zoning reflects the differences in solubility of the salts. (Knapp-USGS)
W71-00070

ON THE FAUNA OF ASELIDAE IN THE BED OF A TRIBUTARY OF THE SAONE (IN FRENCH),
Dijon Univ. (France). Faculty of Science.
Jean-Paul Henry, and Guy Magniez.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 19, Serie D, p 2366-2368, 1970. 1 fig, 8 ref.

Descriptors: *Ecological distribution, *Aquatic animals, *Sediment-water interfaces, Microenvironment, Sediments, River beds, Crustaceans, Diptera, Detritus, Water analysis, Analytical techniques.
Identifiers: *Saone River (France), Subsurface water environments, Interstitial waters, Alluvial deposits, Aselidae, Proasellus.

The method of the interstitial water analysis, developed by Bou and Rouch, permitted to discover an association of four forms of Aselidae in the bed of the Ouche, a tributary to the Saone River. The presence of the two epigeoic sub-species of these crustaceans in the hypogeoic environment (80 centimeters below the benthos) demonstrated the wide ecological amplitude of these amphothalms. The coexistence of Proasellus cavaticus walteri and P c puteans indicated specific heterogeneity of P cavaticus. The distribution of Aselidae suggested the course of geologic dynamics during the quartenary period. (Wilde-Wisconsin)
W71-00103

POPULATION OF CIRCULATING WATER IN THE ZONE OF INTERMITTENT PERCOLATION IN THE KARSTIAN MASSIF (IN FRENCH),
Centre Nationale de la Recherche Scientifique, Moulis (France). Laboratoire Souterrain.
Bernard Delay.
Comptes Rendus Academie des Sciences, Paris, Vol 268, No 5, Serie D, p 1917-1920, 1969. 2 tab, 10 ref.

Descriptors: *Subsurface water, *Capillary water, *Crustaceans, Aquatic population, Population, Percolating water.
Identifiers: *Terrestrial fauna, Karstian massif, Stalagmites, Grottoes, France.

Samples of percolating subterranean water were collected from stalagmites of three grottoes near Castillon-Milhos, France. The filtration procedure yielded 1708 hypogeoic aquatic crustaceans in different stages of development. The organisms included the members of Cyclopoides, Harpacticides, Syncarides, and Asellides. These were accompanied by representatives of terrestial fauna, entrapped by water: Acarinas, Nematodes, Oligochaetes, Rhobdocoeles, and Rotifers. This study affirms the existence of a regular passage of hypogeolic crustaceans across the zone of intermittent percolation of karstian formation. (Wilde-Wisconsin)
W71-00112

THE ARCHIVES FOR GROUNDWATER LEVELS T.N.O. IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
J. H. Beltman.
Annals of Arid Zone, Vol 8, No 2, p 257-266, September 1969. 4 fig, 2 ref.

Descriptors: *Observation wells, *Groundwater, *Regression analysis, *Networks, Data collections, Governments, Hydrologic data, On-site data collections, Water table, Equations, Statistical methods.
Identifiers: *Netherlands, *Groundwater levels, Archives.

Responding to the necessity for groundwater level studies, 3 networks of observation wells--both, for artesian and phreatic water--have been established throughout the Netherlands. The networks are dependent upon the selection of 'key wells' which are observation wells representative of their areas. In most areas, simple statistical relationships exist between groundwater levels in key wells and other wells in their area. Regression lines may be calculated for levels in differing wells, and the statistical theory and its practical applications are described. Problems in measuring abnormal water levels in certain areas due to groundwater withdrawal are discussed. At the present time there are 11,342 observation wells in the country. This type of network is also applicable to areas of the arid Southwest U. S. and elsewhere. (Casey-Arizona)
W71-00144

GEOBOTANICAL STUDIES IN GEO-HYDROLOGICAL SURVEYS IN THE ARID ZONE OF W. RAJASTHAN,
Central Arid Zone Research Int., Jodhpur (India).
P. C. Chatterji, and R. K. Gupta.
Annals of Arid Zone, Vol 8, No 2, p 246-250, September 1969.

Descriptors: *Phreatophytes, *Arid lands, *Xerophytes, *Hydrogeology, *Groundwater, Geomorphology, Water quality, Salinity, Mapping, Petrography, Grasses, Legumes, Plant populations, Exploration.
Identifiers: *India, *Rajasthan Desert, *Geobotany, Groundwater exploration, Groundwater depth, Plant communities, Total soluble salts.

Use of geobotanical methods in groundwater exploration is based on the assumption that areal plant cover characteristics are closely correlated with geological and geo-hydrological conditions. If geobotanical methods are accurate, the areas most useful for well networks and irrigation schemes may be found fairly quickly and inexpensively. A qualitative study attempting to relate differing plant communities to groundwater depth and mineral content was made in the Luni River area of West Rajasthan where groundwater occurs at various depths and is of varied quality. Phreatophytes are extremely useful as indictors of both presence and depth of groundwater. Other plant species associated with the phreatophytes may reflect lithologic and geochemical conditions which in turn are direct or indirect indicators of groundwater quality. Areal maps of groundwater depth and total salt content correlate very closely to the map of plant communities. (Casey-Arizona)
W71-00145

INTERPRETATION OF HYDROGEOLOGIC DATA FOR GROUNDWATER MANAGEMENT,
Geological Survey, Denver, Colo., and Geological Survey, Washington, D.C.
John E. Moore, and Leonard A. Wood.
Annals of Arid Zone, Vol 8, No 2, p 225-230, September 1969. 7 fig, 6 ref.

Descriptors: *Analog models, *Hydrogeology, *River flow, *Groundwater basins, *Regional analysis, Model studies, Structural models, Groundwater mining, Withdrawal, Evapotranspiration, Precipitation (Atmospheric), Aquifers, Water wells, Channel flow, Streamflow forecasting, Aquifer characteristics, Water loss, Pumping, Irrigation water, On-site data collections, Channels.
Identifiers: *Arkansas River Valley (Colorado).

The Arkansas Valley of southeastern Colorado overlays a valley fill aquifer consisting of sand, gravel, clay and silt and averaging 3 miles in width. The Arkansas River is hydraulically connected with the aquifer so that the surface water and groundwater of the area constitute a common water supply, During the dry months river flow is often inadequate for irrigation needs and about 234,000 acre-feet of groundwater are therefore pumped from wells. The physical limits and character of the aquifer were described and mapped and quantitative data were obtained on groundwater levels, precipitation, evapotranspiration, and river gains and losses. River losses were greatest in those areas of greatest pumping, indicating that areal groundwater movements were greatly affected by groundwater withdrawal. With the data from field studies and extensive analog model of the Arkansas Valley hydrologic system was built in an effort to predict various withdrawal effects on the regional water economy. Initial results of 2 channel gain and channel loss analog analyses compared closely with field measurements and further water analysis projects are discussed. (Casey-Arizona)
W71-00150

PERMEABILITY OF CRYSTALLINE ROCK INTERPRETED FROM MEASURED ORIENTATIONS AND APERTURES OF FRACTURES,
Ceara Univ., Fortaleza (Brazil). Dept. of Geosciences; and Colorado School of Mines, Golden.
For primary bibliographic entry see Field 07B.
W71-00151

ROCK MOVEMENT TRIGGERED BY A WATER-LEVEL CHANGE IN THE BRUNSWICK AREA, GEORGIA,
Geological Survey, Brunswick, Ga.
Dean O. Gregg.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C198 - C201, 1970. 4 p, 2 fig, 5 ref.

Descriptors: *Water level fluctuations, *Faults (Geology), *Withdrawal, *Land subsidence, *Movement, Earthquakes, Georgia, Structural geology, Stress, Strain, Artesian wells, Hydrogeology.
Identifiers: Brunswick (Ga).

Anomalous water-level fluctuations attributed to rock movement were recorded simultaneously in three wells tapping the principal artesian aquifer in Glynn County, Ga. During the time of the fluctuations, water levels in the area were rising after an industrial shutdown for the 1964 Christmas holidays and a massive reduction in groundwater withdrawals. It is postulated that the rapidly changing pressures superimposed on older unresolved stress conditions may have triggered subsidence of movement along a suspected fault zone. (Knapp-USGS)
W71-00177

NOTES ON THE POSITION OF A PHOSPHATE ZONE AND ITS RELATION TO GROUNDWATER IN COASTAL GEORGIA,
Geological Survey, Richmond, Va.
Robert L. Wait.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C202, 1970. 4 p, 2 fig, 5 ref.

Descriptors: *Aquifers, *Aquicludes, *Saline water intrusion, *Mining, *Radioactive well logging, Borehole geophysics, Subsurface mapping, Subsurface investigations, Water pollution sources, Clays, Phosphates, Mine drainage.
Identifiers: Glynn County (Ga), Phosphate mining.

Of four inflection points that occur on gamma-radiation logs from the coastal area of Georgia, three are radiation peaks marking phosphate zones in the Eocene to middle and lower miocene rocks. Point A occurs in a sand at the base of a silty clay confining bed that lies above and protects the principal artesian aquifer from sea-water intrusion. Inflection point D occurs at the contact of the Oligocene and upper Eocene limestones. Mining of the phosphate zone marked by point A would breach the silty clay confining bed above the principal artesian aquifer and would allow intrusion of sea water into it. Such sea-water instrusion would destroy the groundwater resources over a wide area of one of the Nation's largest artesian aquifers and would have dire economic consequences for this area. (Knapp-USGS)
W71-00178

NONSTEADY INFLOW TO A CHAMBER WITHIN A THICK AQUITARD,
Geological Survey, Denver, Colo.
W. W. Dudley, Jr.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C206 - C211, 1970. 6 p, 4 fig, 2 tab, 6 ref.

Descriptors: *Groundwater movement, *Aquitards, *Drawdown, *Water yield, *Transmissivity, Steady flow, Unsteady flow, Artesian wells, Excavation, Tunnel construction, Nuclear explosions, Recharge, Discharge (Water), Dewatering.
Identifiers: Leaky artesian aquifers.

Nuclear devices for underground testing must often be kept dry in chambers excavated in rocks of low permeability thousands of feet beneath the water table. For calculating the time-variable discharge to such a chamber, the chamber interval is arbitrarily treated as an aquifer, although the entire zone actually is an aquitard. Those parts of the aquitard above and below the chamber interval are treated as leaky confining beds. Combining the upper and lower recharge systems into a hydraulically equivalent system with only one recharge source allows the application of a type-curve method developed by Hantush for the constant-drawdown, leaky artesian inflow to a well. (Knapp-USGS)
W71-00179

DETERMINING TRANSMISSIVITY FROM WATER-LEVEL RECOVERY OF A STEP-DRAWDOWN TEST,
Geological Survey, Carson City, Nev.
J. R. Harrill.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C212 - C213, 1970. 2 p, 2 ref.

Descriptors: *Groundwater movement, *Transmissivity, *Drawdown, *Theis equation, *Water level fluctuations, On-site tests, Permeability, Storage coefficient, Unsteady flow, Pumping, Discharge (Water).
Identifiers: Step-drawdown tests, Aquifer testing.

A modified form of the Theis recovery formula provides a means of computing transmissivity from the water-level recovery of a step-drawdown test. This variation of the recovery-test techniques is designed primarily for use where no observation wells are available and where it is not feasible to schedule a separate recovery test in addition to a step-drawdown test. (Knapp-USGS)
W71-00180

A SEMIQUANTITATIVE METHOD FOR DETERMINING THE SOURCE OF SPRING-FLOW IN THE MISSOURI OZARKS,
Geological Survey, Rolla, Mo.
G. L. Feder.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C214-C217, 1970. 4 p, 4 fig, 5 ref.

Descriptors: *Springs, *Discharge (Water), *Recession curves, *Missouri, *Karst, Limestones, Carbonate rocks, Surface-groundwater relationships, Artesian wells, Aquifers, Bast flow, Streamflow, Groundwater movement, Water chemistry, Carbonates.
Identifiers: Ozark Mountains (Mo).

Springflow-recession curves in conjunction with data on carbonate saturation can be used to make semiquantitative determinations of the source of springflow in the terranes of carbonate rock of the Missouri Ozarks. The recession curve having the maximum slope represents rapid local drainage through nearby sinkholes, losing streams, cave networks, and flow from the regional artesian aquifer. The curve also represents periods of maximum regional flow from the aquifer. As the local drainage is depleted, the springflow-recession curve slowly approaches the minimum slope and primarily represents flow from the aquifer. During periods when the springflow-recession curve approaches the maximum slope, the saturation of the water with respect to dolomite is low, reflecting the short residence time of the local drainage. As the minimum slope of the recession curve is approached, the saturation with respect to dolomite increases and reflects the greater distance traveled and the longer residence time of the regional artesian water. (Knapp-USGS)
W71-00181

GEOLOGY AND GROUNDWATER RESOURCES OF PITT COUNTY, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
Carlton T. Sumsion.
North Carolina Division of Groundwater Bulletin No 18, March 1970. 75 p, 16 fig, 2 plate, 5 tab, 21 ref.

Descriptors: *Hydrogeology, *Aquifers, *Water resources development, *North Carolina, Groundwater, Water resources, Water quality, Water wells, Artesian wells, Water yield, Transmissivity, Withdrawal, Water supply, Water levels, Data collections, Hydrologic data.
Identifiers: Pitt County (NC).

This report describes the geology and groundwater resources of Pitt County in eastern North Carolina. Mean annual precipitation in the county is approximately 48 inches. The topography of the county is typical of the Coastal Plain Province, a flat, sandy plain whose only steep slopes are along stream-valley terraces. Nearly flat-lying surficial sediments of Holocene and Tertiary age overlie strata of Cretaceous age which dip gently to the southeast. Seven major aquifers serve as sources of groundwater. Groundwater is recovered from both confined and unconfined aquifers; large quantities suitable for industrial or municipal supplies are obtained from confined aquifers. Current groundwater withdrawal is only a small percentage of recharge, and nowhere has there been an overdraft. Groundwater in the shallow unconfined aquifer is generally slightly acidic and in many cases contains objectionable amounts of iron. Brackish or saline groundwater is present in these deeper strata in the eastern part of the county. (Knapp-USGS)
W71-00188

THE SIGNIFICANCE OF PERCOLATION WATER IN LIMESTONE CATCHMENTS,
Saskatchewan Univ., Regina. Dept. of Geography.
David P. Drew.
Groundwater, Vol 8, No 5, p 8-11, September-October 1970. 4 p, 2 fig, 1 tab, 16 ref.

Descriptors: *Percolation, *Limestones, *Groundwater movements, *Karst, Aquifers, Dye releases, Tracers, Tracking techniques, Flow, Recharge, Soil water movement, Saturated flow, Unsaturated flow, Hydrogeology.
Identifiers: Percolation water, Limestone hydrology, Karst hydrology.

Water not flowing in major conduits in limestone aquifers is designated 'percolation water'. The importance of percolation water in an area is probably a function of rock type, structure and hydrologic characteristics. Experiments undertaken in England and Jamaica tracing percolation water with Pyranine suggest longer flow-through times than for water sinking at discrete points on the surface. The soil cover in an area may be in part responsible for this delay. Results from percolation water traces may be used to compile isochronal maps of limestone catchments. (Knapp-USGS)
W71-00195

USE OF ALLUVIAL FAULTS IN THE STORAGE AND RETENTION OF GROUNDWATER,
Department of Water and Power, Los Angeles, Calif.
For primary bibliographic entry see Field 04B.
W71-00196

A COMPUTER METHOD FOR PUMPING-TEST ANALYSIS,
New Mexico Tech., Socorro. Research and Development Div.
Z. A. Saleem.
Groundwater, Vol 8, No 5, p 21-24, September-October 1970. 4 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Groundwater movement, *Drawdown, *Water yield, *Pumping, Water wells, Least squares method, Parametric hydrology, Computer programs, Transmissivity, Permeability, Storage coefficient.
Identifiers: Pumping tests, Aquifer evaluation.

A computer method for aquifer evaluation is based on the classifical principle of least squares. The sum of the weighted squares of differences between observed drawdowns and drawdowns calculated using theoretical drawdown equations is minimized, treating the aquifer parameters as decision variables. The method can be applied to any flow system for which analytical expressions for the potential distribution are known. The method was successfully applied to four pumping tests, two in nonleaky confined flow systems, one in a leaky confined flow system and one in an anisotropic nonleaky confined flow system. (Knapp-USGS)
W71-00197

MODEL TESTS FOR A HORIZONTAL WELL,
Yehuda Peter.
Groundwater, Vol 8, No 5, p 30-34, September-October 1970. 5 p, 5 fig, 2 tab.

Descriptors: *Groundwater movement, *Water wells, Water table, *Hydraulic models, Model studies, Water levels, Drawdown, Water yield, Infiltration.
Identifiers: *Horizontal wells.

Goundwater flow into a drilled well, consisting of a vertical shaft and radially spaced horizontal intake pipes was studied using hydraulic model tests. The assumption of linearly distributed inflow based on the steady-flow theory of Darcy-Thiem was tested and found satisfactory. (Knapp-USGS)
W71-00198

DETERMINING THE SUSTAINED YIELDS OF WELLS IN CARBONATE AND FRACTURED AQUIFERS,
Pennsylvania State Univ., University Park. Mineral Conservation Section.
For primary bibliographic entry see Field 04B.
W71-00201

LARGE SPRINGS OF FLORIDA'S 'SUN COAST,' CITRUS AND HERNANDO COUNTIES,
Geological Survey, Tallahassee, Fla.
J. A. Mann, and R. N. Cherry.
Florida Bureau of Geology Leaflet No 9, Department of Natural Resources, 1970. 22 p, 15 fig, 1 tab, 9 ref.

Descriptors: *Springs, *Florida, Discharge (Water), Water yield, Water resources development, Water conservation, Karst, Limestones, Hydrology, Hydrogeology, Saline water-freshwater interfaces, Saline water intrusion.
Identifiers: Sun Coast (Fla), Crystal River (Fla), Homosassa Springs (Fla), Chassahowitzka Springs (Fla), Weekiwachee Springs (Fla).

Four large spring complexes in the west-central gulf coast of Florida provide most of the freshwater flow of Crystal, Homosassa, Chassahowitzka, and Weekiwachee Rivers. Combined flow of the rivers averages or exceeds one billion gallons per day, and could have supplied all of Florida's industrial and municipal water used in 1967. The spring complexes are important to the future development of the area as a tourist attraction (the largest industry) and their esthetic and natural resource value. Completed elements of hydrologic investigations in the area include: (1) extensive field reconnaissance to locate all springs and points of potential spring flow under changing hydrologic conditions; (2) detailed analysis of the amount and variation of the salinity of water from wells in the Crystal River basin; (3) determination of the elevation of the piezometric surface in the Floridan aquifer in the coastal area and approximate location of the line where the groundwater level equals sea level; (4) the continuous monitoring of the flow of Crystal River; and (5) an extensive program of recording the discharge, water level, and chemical quality of water from streams, lakes, springs, sinkholes, and wells. Caution should be used in land development so that damage to the springs, the hydrologic system feeding them, and the potable water supplies in the aquifer can be avoided or minimized. (Knapp-USGS)
W71-00207

GEOLOGY AND WATER RESOURCES OF CAMPBELL COUNTY, SOUTH DAKOTA PART III-BASIC DATA,
South Dakota State Geological Survey, Vermillion and Geological Survey, Vermillion, S. Dak.
Lynn S. Hedges, and Neil C. Koch.
South Dakota Geological Survey Bulletin 20, 1970. 172 p, 3 fig, 5 tab, 4 ref.

Descriptors: *Data collections, *Hydrologic data, *South Dakota, Water wells, Aquifers, Geology, Hydrogeology, Water levels, Observation wells.
Identifiers: Campbell County (S Dak).

Data collected in a study of the geology and water resources of Campbell County South Dakota, are presented. Most of the data for this report were compiled during 1965, 1966, and 1967 and consist of four basic types of information: (1) well inventory data, (2) water-level measurements from observation wells, (3) chemical analyses of water samples from selected wells, and (4) lithologic logs of wells and test holes. A compilation of this data is contained in five tables. (Knapp-USGS)
W71-00210

T-WAVE, A COMPUTER CODE FOR ANALYZING THE NONSTEADY GRAVITY DECAY OF A GROUNDWATER ANOMALY,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 07C.
W71-00211

GEOLOGY AND GROUNDWATER RESOURCES OF DECATUR COUNTY, KANSAS,
Geological Survey, Lawrence, Kansas.
Warren G. Hodson.
Kansas Geological Survey Bulletin 196, December 1969. 41 p, 8 fig, 2 plate, 6 tab, 35 ref.

Descriptors: *Hydrogeology, *Aquifers, *Kansas, Groundwater, Water resources, Water resources development, Data collections, Hydrologic data, Water wells, Water levels, Geology, Stratigraphy, Alluvium.
Identifiers: Decatur County (Kans).

Decatur County is a 900 sq-mi area in the High Plains section of northwestern Kansas. The climate is subhumid to semi-arid, with a mean annual precipitation of 18.42 inches. The Ogallala Formation of Tertiary (Pliocene) age overlies the Cretaceous rocks in the upland areas and is the most widespread aquifer in the county. Stream erosion has removed the Ogallala Formation along the principal valleys, but streams, through several cycles of alluviation, have subsequently deposited the more permeable sediments in the valleys. There are 2 principal aquifers in the county--the Ogallala Formation that underlies the upland areas, and the relatively narrow alluvial deposits in the 4 major stream valleys. The upland areas have more areal extent than the alluvial valleys, but the highest yielding wells are in the major valleys where most of the irrigation is practiced. Based on population figures and livestock statistics, an estimated 750 to 1,000 acre-feet of groundwater is used annually in rural areas for household and livestock purposes. Three cities use a total of about 400 acre-feet of groundwater per year. About 17,000 acre-feet of groundwater is appropriated for the irrigation of 10,500 acres. Groundwater in the county is moderately hard, but its quality is adequate for most purposes. (Knapp-USGS)
W71-00227

WATER RESOURCES OF THE GUAYANILLA-YAUCO AREA, PUERTO RICO,
Geological Survey, San Juan, Puerto Rico.
For primary bibliographic entry see Field 02E.
W71-00228

TREND-SURFACE ANALYSIS OF GROUNDWATER FLUCTUATIONS,
Missouri Univ., Rolla.
John D. Rockaway, Jr.
Groundwater, Vol 8, No 3, p 29-36, May-June 1970. 8 p, 8 fig, 8 ref.

Descriptors: *Groundwater, Groundwater basins, Mathematical analysis, Groundwater geology, Groundwater recharge, Water levels, Hydrogeology, *Water level fluctuations, Water resources, Statistical methods, Water table, Aquifers, Statistical analysis, Contours.
Identifiers: Groundwater potential, Groundwater management, *Trend-surface method, *Groundwater hydrology.

With the objective of developing techniques for guidance in selecting areas suitable for future groundwater resource development, a statistical technique of fitting polynomial trend-surfaces to groundwater levels was applied to a test site in Bartholomew County, Ind. Trend-surface maps and maps of the deviations from trend-surfaces were prepared from water-level data and evaluated to establish their relationships with the hydrogeologic regimen. A field testing program for evaluating aquifer parameters concluded that: (1) A mathematically fitted surface may be considered to approximate the water-table or piezometric surface, and is sensitive to fluctuations in the groundwater reservoir; (2) Anomalous areas of the trend-surface represent local effects superimposed on the regional base and may be explained by a particular set of geologic, hydrologic, or manmade conditions; and (3) Trend-surface analysis of hydrogeologic data is a rapid, inexpensive method for predicting and establishing areas of potential groundwater development. (USBR)
W71-00259

ANALYSIS OF HYDRAULIC TESTS IN HOT CREEK VALLEY, NEVADA,
Geological Survey, Denver, Colo.
George A. Dinwiddie.
Geological Survey Open-file Report USGS-474-82, June 1970. 63 p, 40 fig, 4 tab, 3 ref. USAEC Contract AT (29-2)-474.

Descriptors: *Hydrogeology, *Aquifers, *Igneous rocks, *Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.
Identifiers: Aquifer testing, Well testing, Pumping tests.

An analysis is presented of data obtained during hydraulic tests in exploratory holes, Hot Creek Valley, Nevada. The analysis is focused on determining variations in hydrostatic head in the vertical section; transmissivity, hydraulic conductivity, storage coefficients, and velocity of groundwater movement in selected intervals; and inflow to a theoretical chamber. Hole UCe-17 penetrated alluvium, welded tuff, zeolitized bedded tuff, and tuffaceous sediments. The composite water level was 161.0 meters below land-surface datum. Hole UCe-18 penetrated alluvium, lake beds and gypsum, rhyolite, and bedded tuff. The composite water level was 59.8 meters below land-surface datum. Hole UCe-20 penetrated alluvium, welded tuff, and tuffaceous conglomerate. The composite water level was 65.5 meters below land-surface datum. Inflow to a theoretical cylindrical chamber 3.66 meters in diameter and at a depth of from 1,524.4 to 1,533.5 meters below land surface in UCe-20 was computed using a leaky artesian, constant-drawdown formula. Because of many variables and unique conditions, the computation can be considered only as an approximation. The inflow to the theoretical chamber probably would be about 14 cubic meters per day after an elapsed inflow time of about 70 days. Hole HTH-1 penetrated alluvium, welded tuff, and tuffaceous sediments. The composite water level was 168.6 meters below land-surface datum. Transmissivities ranged from 0.000248 to 43.8 cu m per day per m. (Knapp-USGS)
W71-00306

HYDRAULIC TESTING OF WELLS IN CENTRAL NEVADA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00307

GEOLOGY AND GROUNDWATER RESOURCES OF CERRO GORDO COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
H. G. Hershey, K. D. Wahl, and W. L. Steinhilber.
Iowa Geological Survey Water-Supply Bulletin No 9, 1970. 75 p, 24 fig, 1 plate, 10 tab, 41 ref.

Descriptors: *Water resources development, *Iowa, *Groundwater, *Hydrogeology, Aquifers, Water yield, Trnsmissivity, Sandstones, Glacial drift, Water wells, Water quality, Water supply, Industrial water, Municipal water.
Identifiers: Cerro Gordo County (Iowa).

The basic geologic framework underlying Cerro Gordo County, Iowa consists of an igneous or metamorphic Precambrian basement complex overlain by consolidated sedimentary rocks of Precambrian to Cretaceous age, and unconsolidated sand, gravel, and clay of Quaternary age. Groundwater occurs in the sedimentary units of Cambrian through Mississippian age and in the glacial drift and outwash deposits. The chief aquifers are the deep Cambrian sandstones, Jordan aquifer, St. Peter sandstone, Devonian and Mississippian limestone and dolomites, and the Pleistocene glacial drift and related interglacial deposits. Groundwater in Cerro Gordo County is of suitable chemical quality for domestic industrial, or municipal use. The total dissolved solids ranges from 152 mg/liter in water from the shallow bedrock to 885 mg/liter in water from the deep Cambrian sandstones. Municipal pumpage in the county in 1968 was about 1.5 billion gallons; industrial pumpage was about 1.8 billion gallons, and most of the water was obtained from the Jordan aquifer. (Knapp-USGS)
W71-00345

COMPUTATION OF RATE AND VOLUME OF STREAM DEPLETION BY WELLS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W71-00354

GROUNDWATER IN GREENE COUNTY, NEW YORK,
Geological Survey, Albany, N.Y.
William G. Weist, Jr., and Ralph C. Heath.
Greene County Farm and Home News, Vol 53, No 6, p 1, 9-12, June 1970. 5 p, 6 fig.

Descriptors: *Groundwater, *Water resources, Groundwater movement, Aquifers, Aquifer characteristics, Geology, Geochemistry, Water quality, Groundwater recharge, Zone of saturation, Water table, Bedrock, Hydrologic cycle.
Identifiers: Groundwater hydrology, Unconsolidated deposits.

Water in a usable quantity can be obtained from wells in nearly every part of Greene County, New York, and, if the supply is exhausted through excessive use during the summer and fall, it will be replaced during the winter and spring. These desirable features sometimes lead to undesirable practices of waste and pollution. Groundwater is obtained in the county from both the bedrock and from the unconsolidated deposits that cover the bedrock. From the standpoint of groundwater, all the bedrock in Greene County can be lumped into three types: (1) shale, (2) carbonate rocks (such as limestone), and (3) sandstone. The unconsolidated deposits also can be lumped into three units: (1) clay and silt, (2) sand and gravel, and (3) till. Pertinent terminology is explained to insure a better understanding of groundwater hydrology. (Woodard-USGS)
W71-00363

STEAM INJECTION, OIL RECOVERY TECHNIQUES, AND WATER QUALITY,
Orange County Water Pollution Control Dept., Santa Ana, Calif.; and Orange County Flood Control District, Santa Ana, Calif.
For primary bibliographic entry see Field 05G.
W71-00371

GROUNDWATER IN THE PERMAFROST REGIONS OF ALASKA,
Geological Survey, Washington, D.C.
John R. Williams.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $1.00. Geological Survey Professional Paper 696, 1970. 83 p, 25 fig, 4 tab, 270 ref.

Descriptors: *Permafrost, *Alaska, *Water resources development, *Groundwater, *Aquifers, Groundwater movement, Water quality, Water yield, Water supply, Ice, Frozen soils, Frozen ground, Saline water intrusion, Alluvium, Alluvial channels, Hydrogeology.
Identifiers: Permafrost hydrogeology.

Although groundwater in permafrost regions in Alaska occurs according to the same geologic and hydrologic principles prevailing in temperate regions, subfreezing temperatures result in profound modification of groundwater flow systems. Frozen ground is an impermeable layer which: (1) Restricts recharge, discharge, and movement of groundwater, (2) acts as a confining layer, and (3) limits the volume of unconsolidated deposits and bedrock in which liquid water may be stored. Frozen ground in many areas eliminates shallow aquifers and requires that wells be drilled deeper than in similar geologic environments having no permafrost. Local variations in the thickness, areal extent, and temperature of permafrost depend on variable thermal properties of earth materials and on local differences in the rate of heat flow from within the earth, climate, topography, vegetation,

geology, and hydrology. Groundwater occurs above, below, and locally within, permafrost. In the continuous-permafrost zone, the most economically developed sources of water are in unfrozen alluvium beneath large lakes and rivers. In the discontinuous-permafrost zone, groundwater is produced locally from shallow aquifers above permafrost of offshore bars and spits because water within or below the frozen beach deposits is saline. (Knapp-USGS)
W71-00373

2G. Water in Soils

THEORY OF FLOW TO DRAINS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02F.
W71-00007

TWO-LIQUID FLOWS IN POROUS MEDIA,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02F.
W71-00009

PHASE BOUNDARY WATER IN FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
Duwayne M. Anderson.
Army Cold Regions Research and Engineering Laboratory Research Report 274, May 1970. 19 p, 8 fig, 41 ref. DA Task No 1T061102B52A02.

Descriptors: *Frozen soils, *Ice, *Water chemistry, *Crystallography, *Water structure, Boundary processes, Ion transport, Soil structure, Soil chemistry, Freezing, Thawing, Crystallization, Water of hydration, Silicates, Clay minerals, Ion transport, Mass transport, Osmosis.
Identifiers: Ice-soil-water relationships.

Water at phase boundaries plays an important and in some cases the dominant role in governing heat and mass transport, electrical conduction, transmission of compression waves and other processes of importance in frozen soils. This report summarizes presently accepted concepts and information, and discusses significant advances in knowledge. Interfacial regions in frozen soils are of the following types: ice/ice (grain boundary), ice/water/air, silicate/water/silicate (interlamellar), and silicate/water/ice (extralamellar). The liquid portion of the interfacial region should be regarded as a liquid-like solution of the ionic and undissociated substances sorbed by the interface and expelled from the ice during freezing. In spite of strong interfacial forces, the interfacial water exhibits liquid-like mobility in its response to many kinds of driving forces. A zone of strong perturbation and disorder exists immediately proximate to silicate surfaces; protons of water molecules are partially delocalized and more easily dissociated. At a distance of 2 or 3 molecular diameters away from the silicate surface, the interfacial forces create a zone of enhanced order. At some farther distance, there exists a disordered transition zone similar to the ice surface as portrayed in Drost-Hansen's model. (Knapp-USGS)
W71-00044

DESCRIPTION AND CLASSIFICATION OF FROZEN SOILS,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-00068

ORIGIN AND GEOMORPHOLOGY OF THE THAR DESERT,
Ranchi Univ. (India). Dept. of Geography.
For primary bibliographic entry see Field 02B.
W71-00149

ROLE OF INFILTRATION GALLERIES IN AUGMENTING SUPPLIES TO THE PUMPING WELLS IN THE DESERTS,
For primary bibliographic entry see Field 03B.
W71-00152

OBSERVATIONS ON WATER-REPELLENT SOILS IN WESTERN UNITED STATES,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station.
Leonard F. DeBano.
In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 17-29, March 1969. 3 fig, 2 tab, 10 ref.

Descriptors: *Absorption, *Wettability, *Soil texture, *Repellents, Ecosystems, Penetration, Soil types, Soil moisture, Soil horizons, California, Soil texture, Vegetation, Topography, Soil-water-plant relationships, Diffusivity, On-site investigations, Drops (Fluids).
Identifiers: *Water-repellent soils, *Liquid-solid contact angle, *Water drop penetration time, Penetrants.

Although most soils show high affinities for water, some exhibit varying degrees of water-repellency. The degree of water repellence of a given soil may be tested by the water drop penetration time method in which a drop of water is placed on a soil sample and the time interval before absorption of the droplet by the soil is measured. Many workers classify a soil as water-repellent or non-wettable if penetration time is greater than 5 seconds. Other methods of characterizing soil repellency are measurements of the liquid-solid contact angle and diffusivity. Early and continuing observations on water-repellent soils have been made on burned over and unburned watersheds in California where surface runoff is affected. Studies of many areas in the western U. S. have shown a wide distribution of water-repellent soils ranging from alpine areas to low semiarid brushlands. Water repellency may be at least in part a function of soil texture. Coarse, sandy soils have a greater surface area for coating by a hypothesized hydrogen-bonded organic polymer. (Casey-Arizona)
W71-00154

WATER-REPELLENT SOILS IN SOUTHERN CALIFORNIA,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
C. Steven Holzhey.
Supported by U.S. Department of Agriculture, Forest Service, Grant No. 4000. In: Symposium on Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 31-41, March 1969. 3 fig, 1 tab, 9 ref.

Descriptors: *Wettability, *Soil horizons, *Vegetation effects, *Topography, *Climates, *Ecosystems, Repellents, Plant groupings, Chaparral, Arid lands, Mountains, Mosses, Xerophytes, Shrubs, Trees, California, Rainfall, Runoff, Temperature, On-site investigations, Soil surfaces, Seasonal, Subtropic.
Identifiers: *Water-repellent soils, *Subtropical climates, *Herbs, Mesophytes.

Soil water repellence is mainly a function of soil surface horizons and may be either year-round or seasonal. Surface horizons are in turn strongly influenced by vegetation. There are 3 main climatic regions in southern California--inland desert, low elevation marine and high elevation mountain climates. The soil of the mountain regions is rich in decomposing litter from woody plants and water repellence is year-round. As trees and shrubs grade at lower elevations into chaparral, which then grades into Mediterranean-type, herb-dominated coastal communities, water repellence concurrently grades from year-round to strictly seasonal. During the long rainless coastal summer, repellence is minimal but increases sharply during the rainy season. Generally, very dry soils show little repellence. In some areas, ground mats of lichens, liverworts and moss-like species provide seasonal water-repellent cover, promoting runoff. In locales of year-round repellence, coarser sandy soils prevail. Repellent soils also occur in desert-scrub communities, but have been little studied. (Casey-Arizona)
W71-00155

MEASUREMENT OF CONTACT ANGLE, WATER DROP PENETRATION TIME, AND CRITICAL SURFACE TENSION,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. Letey.
Partially supported by U.S. Department of Agriculture, Forest Service, Grant No. 4000. In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 43-47, March 1969. 1 fig, 3 ref.

Descriptors: *Wettability, *Soil physics, *Surface tension, *Capillary action, Pores, Infiltration, Repellents.
Identifiers: *Liquid-solid contact angle, *Critical surface tension, *Water-repellent soils, Ethanol, Effective pore radius.

The liquid-solid contact angle has been one method of characterizing water repellency on plane surfaces, but it cannot be measured within a soil system. The height of capillary rise is a function of the liquid-solid contact angle. It is also a function of pore radius, which is difficult to measure. However, by using ethanol, which has a contact angle of 0, the pore radius can be determined and used to calculate the water contact angle. The water drop penetration method is based on the assumption that the contact angle must be greater than 90 degrees on repellent substances. It is a difficult method to use because the contact angle changes with time. The contact angle is also dependent on the liquid surface tension and in general decreases as surface tension decreases. Critical surface tension is a property of the solid, and the higher it is, the less water repellent the material is. Critical surface tension measurements of soils may lead to a simple efficient repellency indicator, but more research is needed. (Casey-Arizona)
W71-00156

WATER-REPELLENT SOILS AND WETTING AGENTS AS FACTORS INFLUENCING EROSION,
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station; and California Univ., Riverside. Dept. of Soils and Plant Nutrition.
J. S. Krammes, and J. Osborn.
In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 177-187, March 1969. 1 fig, 2 tab, 13 ref.

Descriptors: *Watersheds (Basins), *Wettability, *Soil erosion, *Runoff, *Cost-benefit ratio, Chaparral, Semiarid climates, Mountains, California, Repellents, Debris avalanches, Infiltration, Grasses, Economic justification, Surfactants, Soil-water-plant relationships, Burning, Erosion control, Vegetation regrowth.
Identifiers: *Water-repellent soils, *Wetting agents, Burned-over sites, Plots.

Southern California's steep, unstable, chaparral-covered mountain watersheds often suffer devastating fires followed by great increases in rainfall runoff, debris and soil erosion. Soil tests indicated high soil water-repellence in these areas. It was therefore decided to experiment with surface wetting agents on burned over plots in the San Dimas Experimental Forest. Three plots were treated with 6.6 gallons of alkyl-polyoxyethylene ethanol per acre, resulting in: (1) 95 percent reduction in debris movement, (2) 32 percent runoff reduction after 5 moderate intensity rainstorms and (3) greatly increased grass growth. The lessened

runoff and increased soil moisture probably resulted in more grass seed retained in the area together with better germination conditions. In subsequent years both liquid and granular wetting agents were applied to burnouts in differing areas, usually with similar results. Treatments in one area reduced not only debris yield but also dry crop erosion. In the Los Angeles County Flood Control District the treatment benefit/cost ratio was about 2.5:1. Available data indicate a treatment effectiveness span of about 1 year. The results argue for selective applications in highly erodible areas with water-repellent soils. (Casey-Arizona)
W71-00157

WATER-REPELLENT SOILS AND ANNUAL PLANT COVER IN A DESERT SCRUB COMMUNITY OF SOUTHEASTERN CALIFORNIA,
California Univ., Riverside. Dept. of Life Sciences.
Susan Adams, B. R. Strain, and M. S. Adams.
In: Symposium On Water-Repellent Soils, Proceedings, May 6-10, 1968, University of California, Riverside, p 289-295, March 1969. 5 fig, 5 ref.

Descriptors: *Plant populations, *Xerophytes, *Wettability, *Repellents, *Soil properties, Plant groupings, Plant growth, Arid lands, On-site investigations, Physical properties, Condensation, Surveys, Shrubs, Trees, Stemflow, California, Soil-water-plant relationships, Volatility, Drops (Fluids), Vegetation, Burning, Vegetation regrowth.
Identifiers: *Water-repellent soils, Plant annuals, Plant distribution, Hummocks, Volatilization, Burned-over sites, Scrub.

Fire in a desert scrub area which produced a post-fire vegetational mosaic suggesting annual plant distribution was related to the occurrence of hydrophobic soils. To investigate this possibility plant surveys were conducted on burned and unburned Prosopis, Larrea and Cercidium hummocks. Simultaneously, soil water repellency measures were made using the drop test. In all cases hydrophobic layers were most concentrated around stem areas and were deeper in burned hummocks. These effects were somewhat less pronounced in Cercidium hummocks. Probably greater concentrations around stems resulted from stemflow. The deeper hydrophobic soil depths on burned ground probably indicate the volatilization of some substance during fires followed by condensation at greater depths. If discontinuous, these repellent layers could act to trap and hold soil water around root zones. The distribution on burned soils was uneven, with abrupt transitions to continuous distributions at unburned boundaries. Again, this effect was less emphatic around Cercidium hummocks. Distributions were largely continuous around unburned hummocks. (Casey-Arizona)
W71-00158

NATURAL ORGANIC ACIDS AS AGENTS OF CHEMICAL WEATHERING,
Geological Survey, Denver, Colo.; and Colorado School of Mines, Golden. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-00174

EVALUATION OF INSTALLATION METHODS FOR NEUTRON-METER ACCESS TUBES,
Geological Survey, Idaho Falls, Idaho; and Geological Survey, Denver, Colo.
W. E. Teasdale, and A. I. Johnson.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C237-C241, 1970. 5 p, 7 fig, 5 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, Nuclear meters, Moisture content, Soil moisture, Instrumentation, On-site tests, Boreholes.
Identifiers: Neutron-meter access tubes.

A detailed study evaluated various methods for installing access tubes for a depth-type neutron-meter probe. At a small test site, soil-moisture content was determined by laboratory analysis of undisturbed volumetric samples as well as by means of a neutron-meter probe. Installation of thin-walled aluminum tubes of approximately the same diameter as that of the probe, in a hole small enough for tight contact between tube and soil, yielded the most favorable results. However, other less complicated and more economical methods of installing access tubes could be used with reasonable accuracy, if neutron-meter measurements made at the installation were calibrated against volumetric sampling at the site. Because of the depths involved in groundwater studies one of the simpler, more economical installation methods is more practical than the skintight-fit method and at the same time provides a reasonable degree of accuracy in the measurement of change in the moisture content of soils. (Knapp-USGS)
W71-00187

THE SIGNIFICANCE OF PERCOLATION WATER IN LIMESTONE CATCHMENTS,
Saskatchewan Univ., Regina. Dept. of Geography.
For primary bibliographic entry see Field 02F.
W71-00195

ESTIMATING STEADY-STATE EVAPORATION RATES FROM BARE SOILS UNDER CONDITIONS OF HIGH WATER TABLE,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02D.
W71-00370

RELATION OF PERCOLATION RATES TO SOIL TEXTURE ON SEVERAL INDIANA SOILS,
Soil Conservation Service, South Bend, Ind.; and Purdue Univ., Lafayette.
Ival D. Persinger, and Joseph E. Yahner.
Journal of Soil and Water Conservation, Vol 25, No 5, p 189-191, September-October 1970. 3 p, 1 fig, 1 tab, 4 ref.

Descriptors: *Soil texture, *Percolation, *Indiana, *Soil water movement, *Soil surveys, Planning, Urbanization, Land use, Soil conservation, Land development, Land management, Erosion control.
Identifiers: Land use planning.

A study was conducted in St. Joseph County, Indiana, to determine the relationship between percolation rate and soil texture. Forty sites were selected on nine soil series and relationships developed by regression analysis. A highly significant correlation was obtained on these glacial outwash, glacial till and lacustrine soils. The study determined that planning groups could use soil texture inferred from soil maps as a substitute for percolation rates. (Knapp-USGS)
W71-00392

THICKNESS OF SOIL SOLUM AS A PARAMETER OF PLANT-AVAILABLE WATER STORAGE CAPACITY IN SOILS UNDERLAIN BY CARBONATE ROCKS,
Missouri Water Resources Research Center, Columbia.
C. L. Scrivner, and D. A. Ruppert.
Available from NTIS as PB-195 085, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Missouri Water Resources Research Center, Aug 10, 1970. 111 p, 11 tab, 33 fig, 38 ref, 3 append. OWRR Project No B-022-MO (2).

Descriptors: *Soil, *Soil water, *Limestone, *Clay content, Chert, Prairie, Forest.
Identifiers: Available water, Observed field capacity, 15 bar water, Natural vegetation, Neutron probe.

Available water storage capacities were determined by field measurement in limestone-derived soils with a range in depths to carbonate rock of 15 cm to more than 300 cm. Neutron probe access wells were installed and amounts of water were determined throughout two growing seasons. Each soil layer had a characteristic volume of water (called observed field capacity) after recharge by rain periods. At maximum depletions, water approached 15 bar contents. Equations were developed for the prediction of available water (the volume difference between observed field capacity and 15 bar water) from three soil variables; clay content, chert-stone content and depth to carbonate rock. When effects of chert and clay were accounted for the prediction equation was: Total A.W.C. — 0.11 (cm depth - 102). Depths to limestone of less than 61 cm (67 cm A.W.C.) were too shallow to support forest canopies and the natural vegetation was prairie. Forest species survived where depths were greater than 61 cm and some depletion was observed at greater than 250 cm depth. (Scrivner-Missouri)
W71-00414

INVESTIGATION OF SOIL-STRUCTURE INTERACTION: FLEXIBLE CULVERT PIPES,
Ohio State Univ., Columbus. Engineering Experiment Station.
For primary bibliographic entry see Field 08A.
W71-00441

PHASE BOUNDARY WATER IN FROZEN SOILS,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-00462

2H. Lakes

COMPUTATION FOR CIRCULATION IN STRATIFIED LAKES,
Cornell Univ., Ithaca, N.Y. School of Civil Engineering.
Kwang K. Lee, and James A. Liggett.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7634, p 2089-2115, October 1970. 27 p, 8 fig, 17 ref, 2 append.

Descriptors: *Water circulation, *Density stratification, *Thermal stratification, *Lakes, *Mathematical models, Stratified flow, Winds, Currents (Water), Hypolimnion, Epilimnion, Topography, Mixing.
Identifiers: Stratified lakes, Upwelling.

A mathematical method is developed for calculating the steady-state, three-dimensional, wind driven circulation in a large stratified lake of arbitrary bottom topography and shape on a rotating earth. The stratification is modeled by a two-layer structure in which the hypolimnion and the epilimnion are considered as two distinct layers with different densities and eddy viscosities. The thermocline location responds sensitively to the applied wind stress and has an important effect on the circulation velocity. An off-shore wind is the primary cause of the cold water up-welling near the shore due to the movement of thermocline. The surface current velocity generally has a smaller magnitude and greater deflection angle than in the homogeneous case except near the boundaries. The volume transport is strong and in the downwind direction near the shore in the epilimnion and near the deep center in the hypolimnion. (Knapp-USGS)
W71-00014

IMPLICATIONS OF A TYPE OF EMPIRICAL EVAPORATION FORMULA FOR LAKES AND PANS,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02D.
W71-00024

REGIONAL GROUNDWATER FLOW BETWEEN LAKE SIMCOE AND LAKE ONTARIO,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02F.
W71-00031

THE INFLUENCE OF LAKE LEVEL FLUCTUATION AND THE THERMOCLINE ON WATER CHEMISTRY IN TWO GRADUALLY SHELVING AREAS IN LAKE KARIBA, CENTRAL AFRICA,
Nuffield Lake Kariba Research Station (Rhodesia).
S. M. McLachlan.
Archiv fur Hydrobiologie, Vol 66, No 4, p 499-510, 1970. 4 fig, 2 tab, 15 ref.

Descriptors: *Lakes, *Water level fluctuations, *Thermocline, *Water chemistry, Hydrogen ion concentration, Dissolved oxygen, Alkalinity, Conductivity, Potassium, Carbon dioxide, Sampling, Depth, Thermal stratification, Grasses, Fertilizers, Calcium, Magnesium, Ions, Temperature, Seasonal, Sodium, Phosphates, Benthic flora, Aquatic plants.
Identifiers: *Shelving areas, *Lake Kariba (Africa), Exposed flats, Bottom water, Salvinia auriculata, Potamogeton pusillus, Ludwigia stolonifera, Eragrostis, Inundation, Chironomid.

Lake level fluctuation of Kariba is basically used to control flood waters; a secondary result is naturally induced 'fallowing' of the gradually shelving areas. During 1964-1966 surface and bottom water samples from a number of depth zones between 20 centimeters and 20 meters were collected from two gradually shelving areas. With exception of the 20 centimeter and 20 meter zones, samples from all horizontal depth zones were chemically similar throughout the study period. Effects of thermal stratification, involving a decrease in pH and dissolved oxygen content and an increase in carbon dioxide, were detected in bottom water samples from the 20 meter station during the hot months, September to March. When the lake level rose, it inundated terrestrial grass and dung, and considerable changes were recorded in extremely shallow water (20 centimeters): low pH and oxygen content, high conductivity, alkalinity, carbon dioxide, concentration of potassium ions and to a lesser extent, calcium and magnesium. Although transient and restricted to gently shelving areas, these changes resulting from an annual lake level fluctuation provide a valuable source of nutrients to Lake Kariba. (Jones-Wisconsin)
W71-00101

BIOLOGICAL AND CHEMICAL INVESTIGATIONS ON THE EFFECT OF SEWAGE ON THE EUTROPHICATION OF BAVARIAN LAKES,
H. Liebmann.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 7 p, 5 fig, 1 tab, 27 ref.

Descriptors: *Sewage, *Eutrophication, *Lakes, Aquatic environment, Chemical properties, Phosphorus, Nitrogen, Potassium, Diversion, Algae, Nitrogen fixation, Plankton, Phytoplankton, Bacteria, Zooplankton, Salmonids, Season, Oxygen, Hydrogen sulfide, Distribution, Nannoplankton, Turbidity, Hydrogen ion concentration, Alkalinity, Carbonates, Hardness (Water), Sulfates, Conductivity, Sediments, Tertiary treatment, Nutrients.
Identifiers: *Bavaria, Schliersee, Tegernsee, Anabaena, Coregons, Lyngbya limnetica, Oscillatoria redeckei, Oscillatoria rubescens, Synedra acus, Rhodomonas, Lake Constance, Sewage canals.

Lakes Schliersee and Tegernsee in upper Bavaria were assessed for eutrophication by comparing chemical and biological characteristics before and after sewage diversion. By tertiary treatment with chemical flocculation about 90% phosphorus removal is possible, but a phosphorus residue and a relatively high amount of nitrogen remain. Thus, full canalization around the lakes and discharge of the rapidly flowing effluent after biological treatment appeared the most effective method to achieve improvement. Because climatic conditions preclude pumping sewage for great distances in middle Europe, a proposal was made that local purified sewage effluents be pumped into plastic pipes, submerged in Lake Constance for the shortest routing, where a tertiary treatment with phosphorus removal should be established for the whole sewage. Tertiary treatment may be especially advantageous if there are other lakes and impoundments downstream. Danger that leakage from plastic pipelines may introduce purified sewage into the lake seems minimal when compared to the fact that other possible solutions to the problem may defer the remedy for so long that the eutrophication processes become almost irreversible. (Jones-Wisconsin)
W71-00117

CONTRIBUTION OF RANGE LAND RUNOFF TO LAKE EUTROPHICATION,
Guelph Univ. (Ontario). Dept. of Soil Science.
F. R. Campbell, and L. R. Webber.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 6 p, 1 fig, 4 tab, 10 ref.

Descriptors: *Eutrophication, *Runoff, *Ranges, Nitrogen, Phosphorus, Silica, Seasonal, Lakes, Sampling, Potassium, Aquatic weeds, Water quality, Aquatic weed control, Agricultural watersheds, Sediments, Harvesting, Dredging, Control, Analytical techniques, Nutrients.
Identifiers: Canal Lake (Canada), Myriophyllum spicatum.

Canal Lake (Ontario) is partially defined relative to water quality, weed growth, and nutrient loadings during May 1968-May 1969 inflows. Precipitation contributes directly 73% of nitrogen found in major streams discharging into the lake. Agricultural sources of nitrogen contribute about 0.565 pounds/acre, a figure less than 1/5th of the lowest nitrogen estimate in drainage from a nonfertilized agricultural area. About 1/3rd of the total phosphorus entering Canal Lake presumably originated in insoluble organic forms from weed growth. The nitrogen and phosphorus load in Canal Lake, excluding sediments, is about ten times the annual nitrogen and phosphorus stream inflow. This concentration of phosphorus, higher than in inflowing streams, indicates another phosphorus source sufficient to overcome the diluting streamflow effect. Perhaps the greatest sources of nutrients lie within the lake itself: fall-spring filling and retaining a high nutrient inflow percentage, lake sediments, and decay and release of nutrients from aquatic plants. Septic tanks and weeping tiles are probable nutrient sources. A solution would be prevention of further plant nutrient additions and removal of those present. Chemical controls may be temporarily effective locally. Dredging programs may be warranted. (Jones-Wisconsin)
W71-00118

RECONNAISSANCE BATHYMETRY OF PYRAMID LAKE, WASHOE COUNTY, NEVADA,
Geological Survey, Washington, D.C.
E. E. Harris.
For sale by US Geological Survey, Washington, DC, 20242--Price $0.50. Geological Survey Hydrologic Investigations Atlas HA-379, 1 sheet, 1970. Text, 3 fig, 2 tab, 2 ref.

Descriptors: *Lakes, *Nevada, *Surveys, *Bathymetry, Contours, Depth, Lake morphometry, Measurement, Sounding.
Identifiers: *Pyramid Lake (Nev).

Pyramid Lake, about 30 miles northeast of Reno, Nev., is the terminal water body of the Truckee River system. The principal inflow to the lake is from the Truckee River; local drainage around the lake contributes little. The only outflow is by evaporation. Diversions from the Truckee River for irrigation began about 1860, and they were accelerated considerably following construction of the Truckee Canal in 1905. From 1909 to 1968 the lake level declined from an altitude of 3,869 feet to 3,789 feet above sea level, or 80 feet in 59 years. For the present bathymetric survey, section corners and east-west section lines were used to locate accurately the present shoreline and control points for the fathometer survey grid. A boat-mounted recording fathometer was used to obtain cross-sectional profiles of the lake bottom. Twenty-three cross-sectional profiles were run in an east-west direction at one-mile intervals. One long profile was run roughtly north-south from The Needle Rocks to Anaho Island. Aerial photography was obtained to provide details on the present shoreline configuration. The fathometer profiles and aerial photographs were used to contour the lake bottom. (Knapp-USGS)
W71-00189

A METHOD FOR OBTAINING ANALYTICAL SOLUTIONS TO THE EQUATION FOR WIND-DRIVEN CIRCULATION IN A SHALLOW SEA OR LAKE,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
Marvin E. Goldstein, Willis H. Braun, and Richard T. Gedney.
For sale by NTIS as NASA TN D-5989, price $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Technical Note, NASA TN D-5989, September 1970. 56 p, 13 fig, 11 ref.

Descriptors: *Water circulation, *Lakes, *Winds, *Currents (Water), *Seiches, Topography, Lake basins, Lake beds, Lake morphology, Wind pressure, Wind velocity, Wind tides, Equations, Mathematical studies.
Identifiers: Ekman drift, Lake circulation.

A technique is given for obtaining solutions to a class of partial differential equations including Welander's equation for the wind-driven circulation in shallow seas and lakes. The technique, together with some results based on conformal mapping, is used to solve Welander's equation for a closed body of water. To illustrate the principles involved, the method is used to obtain the complete analytical solution for an elliptically shaped body of water with a particular choice of bottom topography when the depth is greater than one-half the Ekman friction depth. (Knapp-USGS)
W71-00192

SILICATE MINERAL STABILITY AND MINERAL EQUILIBRIA IN THE GREAT LAKES,
Syracuse Univ., N.Y. Dept. of Geology.
Jeffery C. Sutherland.
Environmental Science and Technology, Vol 4, No 10, p 826-833, October 1970. 8 p, 5 fig, 5 tab, 30 ref.

Descriptors: *Water chemistry, *Great Lakes, *Silica, *Clay minerals, Equilibrium, Saturation, Leaching, Glacial drift, Aqueous solutions, Mineralogy, Provenance.
Identifiers: Mineral equilibria (Lake water).

Equilibrium concepts involving silicate minerals and water are applied to chemical data from the North Channel and Lakes Erie, Ontario, and Huron, for understanding of chemical self-regulation in the Great Lakes. Equilibria involving silicates and water are inferred from aqueous chemical data. Concentrations of dissolved silica in surface waters of the remote lakes are attained through dissolution of kaolinite. In deeper waters, metastable equilibria, Ca montmorillonite — gibbsite and muscovite — gibbsite may impose upper limits upon concentrations of silica. Silica concentrations in the enclosed waters of sediments from North Channel reach metastable equilibrium with

amorphous silica. The major chemical character of the Great Lakes is inherited from the carbonate-silicate mineralogy of bedrock, soils, and glacial drift in their drainage. (Knapp-USGS)
W71-00204

DRIFT-BOTTLE STUDY OF THE SURFACE CURRENTS OF LAKE SUPERIOR,
Northern Michigan Univ., Marquette; and Michigan Univ., Ann Arbor.
John D. Hughes, John P. Farrell, and Edward C. Monahan.
Michigan Academician, Michigan Academy Science, Arts and Letters, Vol 2, No 4, p 25-31, Spring 1970. 7 p, 2 fig, 6 ref.

Descriptors: *Currents (Water), *Lake Superior, *Data collections, *Drift bottles, Drifting (Aquatic), Flow, Hydrologic data.
Identifiers: Lake Superior currents.

A total of 2436 drift bottles has been released from 205 different stations in Lake Superior since 1966. By Jan. 1, 1969, 237 drifters were returned out of the 2436 released--an overall return of 11 percent. There appears to be a general counter-clockwise current around the entire perimeter of the lake. A broad current flows eastward along the entire south shore during all seasons that drifters were put into the lake. When this current reaches the southeastern corner of the lake it turns counter-clockwise and follows the eastern shore as far as Rossport, in the northernmost part of the lake. From Rossport the current continues its counter-clockwise movement around the lake by turning southwestward but drifts away from the shoreline as it encounters bottom water that wells upward along the entire northwestern side of the lake. (Knapp-USGS)
W71-00212

COMPETITIVE RECREATIONAL USES OF SELECTED IOWA LAKES,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 06B.
W71-00230

DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-00355

THE LATERIAL DISTRIBUTION OF CLAY MINERALS IN LAKES PONTCHARTRAIN AND MAUREPAS, LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-00391

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER.
For primary bibliographic entry see Field 05B.
W71-00397

WHITE SUCKER SPAWNING AND CULTURE OF THE YOUNG IN THE LABORATORY,
National Water Quality Lab., Duluth, Minn.
John G. Hale.
The Progressive Fish-Culturist, Vol 32, No 3, p 169. FWQA Project ETK 18050 ---9/70.

Descriptors: *Fish reproduction, Life history, Studies, *Spawning, Fish diets, Fish growth, Bioassay methods.
Identifiers: *Fish culture, Catostomus commersoni.

White suckers (Catostomus commersoni) collected from a lake inlet were placed in a rectangular tank at inlet water temperature (16C) and provided with a coarse gravel substrate. About 40 hours after the fish had been placed in the tank, eggs were found and after 7 days hatching was about 90 per cent complete. Larval fish were offered live brine shrimp and ground commercial trout starter 3 days after hatching. Seven days after hatching brine shrimp were found in 54 per cent of the fish; trout starter in only 15 per cent. About 1 month after hatching, commercial trout granules (No. 1) and trout starter were fed at a 50:50 ratio, replacing the brine shrimp. Thereafter, the trout food was found in 90 to 95 per cent of the stomachs. One week after hatching, the fish were 12 to 13 millimeters long; 3 months later they were 20 to 34 millimeters long. (Hale-FWQA)
W71-00408

EFFECTS OF ZOOPLANKTON ON PHOTOSYNTHESIS BY ALGAE IN LAKES,
Richmond Univ., Va. Dept. of Biology.
John W. Bishop.
Completion Report, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, October 1970. 4 p. OWRR Project No A-022-VA (1).

Descriptors: Aquatic productivity, *Vertical migration, Impounded waters, Lakes, *Zooplankton, *Algae, *Photosynthesis.

The objective was to measure the extent to which zooplankton control natural populations of algae. Algae with different concentrations of zooplankton were enclosed in aquariums in Westhampton Lake, Virginia. Properties of the water, algae and zooplankton within and without the aquariums were measured over several days. Of the zooplankton examined, rotifers, cladocerans and copepods, only rotifers significantly affected photosynthesis. Rotifers at a concentration of 1,000 animals liter-1, the average for the summer, decreased photosynthesis 0.125 ppm 0 sub 2 hr-1 daily. This value represents 22% of the average rate of photosynthesis. None of the zooplankton significantly affected photosynthetic efficiency, photosynthesis per unit chlorophyll. Daily variations in photosynthesis were correlated with rainfall. Photosynthesis increased several days after rainfall. The increase resulted not from increased chlorophyll, but from increased photosynthetic efficiency of the algae. (Bishop-Richmond)
W71-00416

MATHEMATICAL MODEL OF SIMPLEST HYDROECOLOGICAL SYSTEM,
For primary bibliographic entry see Field 06A.
W71-00440

THE IRRELATION OF CARBON AND PHOSPHORUS IN REGULATING HETEROTROPHIC AND AUTOTROPHIC POPULATIONS IN AQUATIC ECOSYSTEMS,
Federal Water Quality Administration, Athens, Ga. National Pollutants Fate Research Program.
For primary bibliographic entry see Field 05C.
W71-00475

2I. Water in Plants

REVEALING BY PHYSICAL PROCEDURE THE SHORT-DURATION FLUCTUATIONS IN THE DENSITY OF VEGETATION OF MOUNTAIN STREAMS. DEFINITION OF A NEW BIOLOGICAL TEST IN WATER ANALYSIS, THE BIOCHEMICAL DEMAND FOR MINERAL SALTS (IN FRENCH),
Bernard Serra-Tosio.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 6, Serie D, p 1167-1170, 1970. 1 fig, 4 ref.

Descriptors: *Streams, *Sampling, *Aquatic plants, Analytical techniques, Water analysis, Biochemistry, Nutrient requirements, Demineralization, Phytoplankton, Test procedures.
Identifiers: Biological activity, Mineral salts, 'Nychthemeralic' drift, Biological test, Aquatic vegetation density.

Analyses of river water performed in 4-hour intervals have indicated that variation in the concentration of soluble salts is correlated with the time of sampling and corresponding biological activity. Incubation of water samples in the laboratory for 4 to 6 days at 20-23C produced a considerable demineralization of water which nevertheless exhibited a similar diurnal variation in its salt concentration. The differences between the results of analyses, performed at the same time of day and expressed in milligram/liter, are designated as the biochemical demand for mineral salts. Determination of this value is said to provide a picture of the diurnal 'drift' in vegetation density. (Wilde-Wisconsin)
W71-00104

GEOBOTANICAL STUDIES IN GEO-HYDROLOGICAL SURVEYS IN THE ARID ZONE OF W. RAJASTHAN,
Central Arid Zone Research Int., Jodhpur (India).
For primary bibliographic entry see Field 02F.
W71-00145

RESPONSE OF AGRICULTURAL CROPS TO FLOODING, DEPTH-OF-WATER TABLE AND SOIL GASEOUS COMPOSITION,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 03F.
W71-00217

EFFECT OF SOIL WATER STRESS AND SOIL TEMPERATURE ON TRANSLOCATION OF DIURON,
Oregon State Univ., Corvallis. Dept. of Soils.
R. H. Sedgley, and L. Boersma.
Weed Science, Vol 17, No 3, p 304-306, July 1969. 3 p, 2 fig, 1 tab, 10 ref. OWRR Project B-001-ORE (1).

Descriptors: *Path of pollutants, *Herbicides, *Translocation, Weed control, Wheat, Soil moisture, Soil temperature, Pesticide kinetics, Soil water movement, Osmosis, Moisture stress, Water requirements.
Identifiers: Diuron.

Rates of photosynthesis, respiration, and transpiration of wheat were determined as functions of time, under controlled conditions of moderate soil water stress and soil temperature, after treatment of the roots with 3- (3, 4-dichlorophenyl)-1, 1-dimethylurea (diuron). Air temperature, relative humidity, light intensity, and air movement were maintained constant. The rate of photosynthesis declined with time for all plants treated with diuron but not for the controls. No change in the rate of respiration was detected. The rate of transpiration decreased slightly immediately upon application of the diuron and then remained constant. Soil temperature and soil water stress play important roles in the herbicidal action of diuron applied to the soil. (Knapp-USGS)
W71-00226

THE NUTRIENT CYCLES OF AN ECOSYSTEM,
Forest Service (USDA), Laconia, N.H. Hubbard Brook Experimental Forest.
For primary bibliographic entry see Field 02K.
W71-00374

AN ANNUAL REPORT OF THE CHEMICAL CONTROL OF ALLIGATORWEED,
University of Sourthwestern Louisiana, Lafayette. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 04A.
W71-00396

EVAPOTRANSPIRATION AS AFFECTED BU PLANT DENSITY AND WATER-TABLE DEPTH,
Agricultural Research Service, Fort Lauderdale, Fla. Plantation Field Lab.
For primary bibliographic entry see Field 02D.
W71-00402

OCEAN PHOTOSYNTHESIS. EFFECTS OF HYDROSTATIC PRESSURE ON PHOTOSYNTHESIS AND GROWTH OF UNICELLULAR MARINE ALGAE AND DIATOMS,
Hawaii Univ., Honolulu. Dept. of Microbiology.
Leslie R. Berger, Leslie Q. Tam, and Danny H. Pope.
Available from NTIS as AD-70 4496, $3.00 in paper copy, $0.95 in microfiche. First Annual Progress Report, April 1, 1970. 15 p.
Identifiers: *Photosynthesis, *Hydrostatic pressure, *Marine biology, Photosynthesis, Algae, Growth, Oxygen, Instrumentation, Experimental design.

Photosynthesis, measured as light-dependent evolution of oxygen was demonstrated in both green and blue-green algae species at hydrostatic pressures exceeding 600 atmospheres. The methodology which made these observations possible is described. A technique to grow obligately aerobic organisms at increased pressures to high population densities is also described.
W71-00449

THE IRRELATION OF CARBON AND PHOSPHORUS IN REGULATING HETEROTROPHIC AND AUTOTROPHIC POPULATIONS IN AQUATIC ECOSYSTEMS,
Federal Water Quality Administration, Athens, Ga. National Pollutants Fate Research Program.
For primary bibliographic entry see Field 05C.
W71-00475

2J. Erosion and Sedimentation

SEDIMENT SAMPLING EFFICIENCY OF SLOTS,
Iowa Univ., Iowa City; and Technion - Israel Inst. of Technology, Haifa.
Michael Poreh, Abraham Sagiv, and Ido Seginer.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7637, p 2065-2078, October 1970. 14 p, 14 fig, 4 ref.

Descriptors: *Sampling, *Bed load, *Sediment load, Sediment transport, Particle size, Open channel flow, Alluvial channels, Instrumentation, Hydraulic models.
Identifiers: Bed-load samplers, Slots.

The sediment sampling efficiency of two-dimensional slots in open channel was studied. Eight fractions of sand and gravel were used ranging in size from 0.2 mm to 4.5 mm. A universal relation between the efficiency, the Froude number and the particle size was established for what is termed the bed load transport range. It was found that the sampling efficiency in this range decreases slightly with particle size and approaches one for large slots openings. The sampling efficiency of smaller particles, which do not move as bed load, was found to increase with particle size but remained smaller than one even for extremely large slot size to particle size ratios. (Knapp-USGS)
W71-00016

SEDIMENT-PICKUP FUNCTION,
Department of Energy, Mines, and Resources, Burlington (Ontario). Canada Centre for Inland Waters; Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering; and Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
Albert R. LeFeuvre, Hilmi D. Altinbilek, and Marion R. Carstens.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7636, p 2051-2063, October 1970. 13 p, 7 fig, 2 tab, 6 ref, append.

Descriptors: *Stream erosion, *Bed load, *Sediment transport, Fluid friction, Density, Velocity, Scour, Deposition (Sediments), Dunes, Channel morphology, Sedimentary structures, Hydraulic models.
Identifiers: Drag, Lift.

A function expressing the rate of removal of bed is presented in terms of the following variables: Local velocity; coefficient of drag; particle diameter; bed slope; angle of repose; and fluid density in the vicinity of the particle. The variables of the function are established by consideration of the forces acting on a typical surface particle. The functional relationship was established by the results of an experimental study. The sediment-pickup function is formulated as a local rate of bed removal in order to be able to incorporate the function in the differential form of the equation of continuity. (Knapp-USGS)
W71-00017

EXPERIMENTAL INVESTIGATION OF FORM OF BED-ROUGHNESS,
Southeastern Massachusetts Univ., North Dartmouth, Dept. of Civil Engineering.
Sat Dev Khanna.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7623, p 2029-2040, October 1970. 12 p, 12 fig, 7 ref, append.

Descriptors: *Channel morphology, *Roughness (Hydraulic), *Open channel flow, *Bed load, *Sediment transport, Dunes, Ripple marks, Turbulent flow, Turbulence, Pressure, Waves (Water), Friction, Fluid friction, Hydraulic models.
Identifiers: Drag, Form drag.

Experimental observations regarding mean velocity distribution, angle of flow, static pressure distribution and longitudinal turbulence intensity are all made along a typical wooden wave in the domain of ripples and dunes of river flow. The wave was produced in a low-turbulence wind tunnel and the measurements were made by hot-wire anemometry in an air medium. From these observations skin friction coefficient, form drag, and other boundary layer parameters have been evaluated to help analyze the process of sediment transport. (Knapp-USGS)
W71-00018

PREDICTING CONCENTRATION PROFILES IN OPEN CHANNELS,
Geological Survey, Fort Collins, Colo.; and Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 08B.
W71-00020

SEDIMENT-SEAWATER INTERACTION IN GLACIOMARINE SEDIEMENTS OF SOUTHEAST ALASKA,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W71-00027

OSCILLATION RIPPLEMARKS AND ORBITAL DIAMETER,
Esso Production Research Co., Houston, Tex.
R. A. Baker.
Geological Society of America Bulletin, Vol 81, No 5, p 1589-1590, May 1970. 2 p, 4 ref.

Descriptors: *Ripple marks, *Sedimentary structures, Waves (Water), Equations, Statistics, Sedimentation, Beaches, Sands.
Identifiers: Wave orbital diameter.

Ripplemark wavelength, is related to median sediment diameter and orbital diameter of waves at the sea floor by an empirical equation which indicates an inverse relationship between ripplemark wavelength and orbital diameter, a result contrary to expectation. Away from the shoreline, ripplemarks are far apart and translatory motion is small, while ripplemarks near the shorline are closely spaced and translatory motion is large. (Knapp-USGS)
W71-00035

A STUDY OF STREAM BEHAVIOR IN THE CANTERBURY FOOTHILLS, NEW ZEALAND,
New Zealand Forest Service, Wellington. Forest Service Inst.
For primary bibliographic entry see Field 02E.
W71-00042

SEDIMENT YIELDS OF WISCONSIN STREAMS,
Geological Survey, Washington, D.C.
S. M. Hindall, and R. F. Flint.
For sale by US Geological Survey, Washington, DC 20242 - Price $0.75. Geological Survey Hydrologic Investigations Atlas HA-376, 1 sheet, 1970. Text, 1 fig, 4 map, 1 tab, 15 ref.

Descriptors: *Sediment yield, *Wisconsin, *Sediment load, Provenance, Glacial drift, Loess, Erosion, Maps, Survey, Data collections, Sampling, Gaging stations.
Identifiers: Sediment yield map.

The purpose of this 1-sheet hydrological atlas is to describe the magnitude and variability of sediment in Wisconsin streams, to relate sediment yields to the local environment, and to identify areas that need further study. The report is based on sediment data from 44 stream-gaging sites throughout the State. The average concentration of sediment for the 44 sampled sites throughout the State is 157 mg/liter. Annual basin yields range from 5 to 700 tons per square mile and from 0.5 to 230 acre-feet of sediment volume. Soil types, parent glacial deposits, land use and cover, and topography greatly influence sediment yields. Lowest yields generally come from forested, sandy areas with low topographic relief. The highest yields are from land that is intensely farmed, hilly, and partly covered by loose wind-blown silt. Intermediate yields are from areas of intense agricultural development, where tilled soils are exposed to erosion during a large part of each year. The sediment yield map, prepared from calculated long-term yields and by inference from knowledge of land use, soils, and glacial geology, shows in most areas of the State. (Knapp-USGS)
W71-00050

CARBON-14 CONTENT AND ORIGIN OF CALICHE,
Arizona Univ., Tucson. Dept. of Geology.
Joel J. Sigalove.
MS Thesis, Arizona University Graduate College, 1968. 64 p, 10 fig, 4 tab, 45 ref.

Descriptors: *Caliche, *Deposition (Sediments), Radioactive dating, Hardpan, Calcium carbonate, Leaching, Chemical precipitation, Evaporation, Limestones, Soil chemistry, Water chemistry, Soil water movement, Groundwater movement, Arizona.
Identifiers: San Francisco Volcanic Field (Ariz).

Caliche on various surfaces of known relative age was studied in the San Francisco Volcanic Field near Flagstaff, Arizona. Laboratory studies included carbon-14 analyses of the samples from vertical sections in the southern part of the state. Some caliche is deposited by the evaporation of water in the crevices and on the bottom surface of calcium-rich rocks lying upon the land surface. Most caliche is deposited by the evaporation of water infiltrating through the unsaturated zone. Carbon-14 activity decreases with depth in any given vertical section. In the San Francisco Field, the carbon-14 concentrations of caliche deposits on the younger volcanic surfaces were higher than those found for the

thicker deposits on the older surfaces. Caliche appears to be presently forming at an appreciable rate on surfaces within the San Francisco Volcanic Field. (Knapp-USGS)
W71-00063

A METHOD OF COMPUTING SOIL MOVEMENT THROUGHOUT A FIELD,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.; and Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
C. A. Onstad, C. L. Larson, L. F. Hermsmeier, and R. A. Young.
American Society of Agricultural Engineers Transactions, Vol 10, No 6, p 742-745, 1967. 4 p, 7 fig, 2 tab, 4 ref.

Descriptors: *Soil erosion, *Forecasting, Equations, Runoff, Profiles, Topography, Soil conservation, Model studies, Slopes, Terracing.
Identifiers: Soil erosion forecasting.

An erosion model was designed to provide a basis for computing soil losses with consideration of local variations in slope steepness. The model is useful in obtaining a distribution of net soil loss throughout a topographic profile of any type. A profile classification and terminology are proposed. For curved profiles, the model represents some improvement over an estimate based on mean slope steepness. The model is applicable primarily to the case of two-dimensional erosion, that is, where runoff and erosion occur along parallel lines. Modification would permit consideration of the general case of three-dimensional erosion, where erosion takes place along nonparallel lines. (Knapp-USGS)
W71-00069

ADSORPTION AND DESORPTION OF INORGANIC PHOSPHORUS BY LAKE SEDIMENTS IN A 0.1 (MOLE) NaCl SYSTEM,
Wisconsin Univ., Madison. Dept. of Soil Science.
J. D. H. Williams, J. K. Syers, R. F. Harris, and D. E. Armstrong.
Environmental Science and Technology, Vol 4, No 6, p 517-519, 1970. 2 tab, 11 ref. OWRR Project B-022-WISC.

Descriptors: *Adsorption, *Inorganic compounds, *Phosphorus, *Sediments, *Lakes, Sodium chloride, Calcium compounds, Sampling, Wisconsin, Productivity, Oxygen, Hypolimnion, Thermal stratification, Eutrophication, Oligotrophic, Retention.
Identifiers: *Desorption, Lake Mendota (Wis), Wisconsin lakes, Calcareous lake sediments, Noncalcareous lake sediments, Adsorption-desorption.

Results of investigations of adsorption and desorption of inorganic phosphorus in a 0.1 mole sodium chloride system by lake sediments of contrasting chemical composition are described. Sediments were sampled from Wisconsin lakes. Noncalcareous sediments generally adsorbed and retained more added inorganic phosphorus than calcareous lake sediments. Sediments retaining the most added phosphorus during adsorption tended to release the least phosphorus during a subsequent desorption at all levels of added phosphorus. Net amount of added phosphorus adsorbed (following adsorption and desorption) was lowest for calcareous sediments--with one exception--at the highest level of added phosphorus (50 micrograms of phosphorus/milliliter). Reactions involved in adsorption and desorption of added phosphorus were not always completely reversible during the experimental period. A close relationship was found between the order of sediment capacity to retain added phosphorus in the laboratory and the levels of native total phosphorus and inorganic phosphorus in the sediment. No consistent relationship appears to exist between lake eutrophication and phosphorus retention capacity; apparently, the state of lake eutrophication cannot be explained solely on the basis of capacity of sediments to retain phosphorus. (Jones-Wisconsin)
W71-00115

CHANNEL-SCARP FORMATION IN WESTERN NORTH DAKOTA,
Geological Survey, Grand Forks, N. Dak.
For primary bibliographic entry see Field 04D.
W71-00185

A METHOD OF ESTIMATING ANNUAL SUSPENDED-SEDIMENT DISCHARGE,
Geological Survey, Tacoma, Wash.
Leonard M. Nelson.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C233-C236, 1970. 4 p, 5 fig, 1 tab, 1 ref.

Descriptors: *Sediment load, *Suspended load, *Sediment transport, *Discharge (Water), *Sediment discharge, Peak discharge, Streamflow, Sediment yield, Washington, Hydrogeology, Gaging stations, Sampling, Statistical methods, Data collections, Hydrologic data.
Identifiers: Streamflow-sediment discharge relations.

A simple method is proposed for estimating annual suspended-sediment discharge during years for which stream-flow records are available but for which sediment records are not available. Readily accessible information on the parameters of annual peak and annual mean water discharges is used with the available sediment records to estimate the average annual suspended-sediment discharge. The relation between the two parameters and the annual suspended-sediment discharge is well defined for many streams. This relation does not fit all streams, however, and a thorough understanding of a basin's geologic and hydrologic characteristics is needed for application of the method proposed. (Knapp-USGS)
W71-00186

GEOLOGY, MINERAL DEPOSITS, AND GEOCHEMICAL AND RADIOMETRIC ANOMALIES, SERPENTINE HOT SPRINGS AREA, SEWARD PENINSULA, ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W71-00203

GLACIAL EROSION, ICE RAFTING, AND GLACIAL-MARINE SEDIMENTS: ANTARCTICA AND THE SOUTHERN OCEAN,
Florida State Univ., Tallahassee. Dept. of Oceanography.
Detlef A. Warnke.
Amerian Journal of Science, Vol 269, No 3, p 276-294, October 1970. 19 p, 2 fig, 2 tab, 79 ref. NSF Grants GA-264, GA-657, and GA-1320.

Descriptors: *Glaciers, *Erosion, *Sediment transport, *Glacial drift, *Antarctic, Regimen, Icebergs, Rheology, Scour, Sedimentation, Sedimentation rates, Sediment load.
Identifiers: Antarctica, Glacial erosion efficiency.

The Antarctic continent is surrounded by glacial-marine sediments deposited by melting icebergs. Modern Antarctic glaciers and icebergs, however, carry no or very little debris. This points to a period of heightened erosional efficiency at some stage in the early development of Antarctic glaciation. The results of field studies in the ice-free areas of the continent, as reported in the literature, seem to confirm this view. The period of maximum efficiency was gradually phased out when easily erodible, weathered material was no longer available, or when the ice-substrate boundary conditions changed over significant portions of the continent, or when some form of geomorphic equilibrium was attained. These various explanations are not mutually exclusive; they are in part interrelated. The overall decrease in erosional efficiency of Antarctic glaciers is reflected in available deep-sea core descriptions. Additional studies aimed to confirm, modify, or reject this view and to define the newly demonstrated ice-sheet fluctuations offer promising avenues for further sediment-petrographic investigations of Antarctic core material. (Knapp-USGS)
W71-00346

MODEL SIMILARITY CONCERNING THE TRANSPORT OF SUSPENDED MATTER IN A TURBULENT FLOW FIELD,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 08B.
W71-00358

DIMENSIONAL ANALYSIS OF ALLUVIAL CHANNELS WITH SPECIAL REFERENCE TO MEANDER LENGTH,
Hydraulics Research Station, Wallingford (England).
Peter Ackers, and F. G. Charlton.
Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 287-316, 1970. 30 p, 4 fig, 1 tab, 26 ref.

Descriptors: *Alluvial channels, *Meanders, *Channel morphology, *Discharge (Water), *Sediment load, Sediment transport, Sands, Open channel flow, Data collections, Particle size, Hydraulic models, Dimensional analysis.
Identifiers: Meander length.

Discharge, sediment load, hydraulic gradient and channel geometry were measured in channels in an area of fine sand which achieved a meander pattern through natural processes, at discharges between 0.006 and 0.09 cu m/sec. Channels with small sediment loads remained straight and meandering occurred naturally at higher sediment loads. Dimensionless parameters were derived which provide a good framework for the analysis of stream geometry. No simple relation between meander length and discharge is completely satisfactory and none of the many empirical relations between meander length and discharge appears to have special physical significance. (Knapp-USGS)
W71-00361

SOME GEOLOGICAL CHARACTERISTICS OF SEDIMENTS FROM THE NORTH ATLANTIC OCEAN,
Utrecht Rijksuniversiteit (Netherlands). Vening Meinesz Lab. for Geophysics and Geochemistry.
C. H. Van der Weijden, R. D. Schuiling, and H. A. Das.
Marine Geology, Vol 9, No 2, p 81-99, September 1970. 19 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Bottom sediments, *Water chemistry, *Geochemistry, *Atlantic Ocean, Clay minerals, Oceans, Mineralogy, Sampling, Ion exchange, Salts, Saline water systems, Clays, Analytical techniques, Chemical analysis.
Identifiers: Sedimentary geochemistry.

Eh- and pH-meansurements were made in a number of North Atlantic deep-sea sediments. Ten cores with marked changes in redox potential were analyzed for Si, Al, Na, K, Cl, Fe, Mn, Co, Sc, Cu, and carbonate. A significant correlation was found between Eh and Mn-content. Fe, Co, and Sc are correlated with the illitic clay-content, while no relation was found between Cu and any other main constituent. The examined sediments chiefly consist of calcium carbonate, quartz, feldspars, and illitic clays. (Knapp-USGS)
W71-00362

FORMATION OF THE BARRIER SPIT AND OTHER SAND RIDGES NEAR CHILKA LAKE ON THE EAST COAST OF INDIA,
Washington Univ., Seattle. Dept. of Oceanography.
K. Venkatarathnam.
Marine Geology, Vol 9, No 2, p 101-116, September 1970. 16 p, 6 fig, 2 tab, 20 ref. USGS Contract 14-08-0001-10924.

Descriptors: *Sedimentation, *Sedimentary structures, *Sand bars, *Sand spits, Coasts, Currents (Water), Sediment transport, Geomorphology, Waves (Water), Lagoons, Provenance.
Identifiers: Spits, India, Chilka Lake (India).

Chilka Lake is a lagoon on the east coast of India. It is separated from the Bay of Bengal by a barrier spit attached at the southern end. Landward of the spit, but adjacent to it, are a number of other sand ridges, some of which are parallel to the coast. The morphology and composition of the sediments forming the spit and other ridges, the bathymetry of the continental shelf off Chilka Lake, the waves and wave refraction, and the tidal and river currents in the region are described. Considerable quantities of sand for the building of the spit and the other ridges were derived from the adjacent seabed and/or from the land south of Chilka Lake. The processes of deposition of the spit and the ridges were initiated sometime during the last sea-level rise, before 3,750 years B.P. Constructive wave action and northward drift were the main processes in the building of the spit from the southern part where there is an abrupt curvature in the solid coastline. The changes in the orientation of the spit are due, in particular, to the differences in the shelf gradients off the coast, the absence or presence of strong river and tidal currents, and the pattern of wave refraction. (Knapp-USGS)
W71-00365

MAGNETIC PROPERTIES OF SOME CANYON SEDIMENTS,
Southampton Univ. (England).
A. I. Rees.
Marine Geology, Vol 9, No 2, p M12-M16, September 1970. 5 p, 4 fig, 5 ref. NSF Grant GP 111.

Descriptors: *Sedimentary structures, *Sands, *Magnetic studies, Oceanography, Ocean currents, Marine geology, Tides, Topography, Coasts, Deposition (Sediments), Sedimentation.
Identifiers: Magnetic fabric (Sediments), Baja (Cal).

The magnetic fabrics of two box samples from the Santa Maria Canyon, Baja, California, are primary in style although one is extensively burrowed. The fabrics are caused at least in part by depositional dips. (Knapp-USGS)
W71-00366

MAGNETIC FABRIC OF SEDIMENTS FROM THE SHELF AT LA JOLLA (CALIFORNIA),
Southampton Univ. (England).
N. Hamilton, and A. I. Rees.
Marine Geology, Vol 9, No 2, p M6-M11, September 1970. 6 p, 3 fig, 3 tab, 10 ref. ONR Contract 2216 (05), NSF Grant GP 3373.

Descriptors: *Sedimentary structures, *Sands, *Magnetic studies, Oceanography, Ocean currents, Marine geology, Tides, Topography, Coasts, Deposition (Sediments), Sedimentation.
Identifiers: Magnetic fabric (Sediments), La Jolla (Calif).

The magnetic fabrics of seven oriented box cores taken in water depths less than 100 m near La Jolla, California are described. All are fine sands and except a relict beach sediment, all appear to have been in sedimentary equilibrium with present conditions. They show signs of burrowing. The present magnetic fabric of all samples show signs of distrubance. Four of the seven retain sufficient primary fabric for a current direction to be estimated. There is evidence that the fabric disturbance is a result of the organic activity. (Knapp-USGS)
W71-00367

EVIDENCE OF SEDIMENTATION BY GRAVITY-ASSISTED BOTTOM CURRENTS IN THE MEDITERRANEAN SEA,
Florence Univ. (Italy). Inst. of Geology; and SACLANT ASW Research Centre, La Spezia (Italy).
C. Bartolini, and G. E. Gehin.
Marine Geology, Vol 9, No 2, p M1-M5, September 1970. 5 p, 3 fig, 5 ref.

Descriptors: *Sedimentation rates, *Oceans, *Turbidity currents, Deposition (Sediments), Sediment distribution, Sediment transport, Bottom sediments, Sampling, Oceanography, Stratification.
Identifiers: Mediterranean Sea.

Differences in the sedimentation rates of hemipelagic muds in the western Mediterranean were estimated by sampling. Within a water depth difference of 9 m, corresponding to a distance on the sea bottom of only 5 nautical miles, the sedimentation rate doubles from about 20 cm/1,000 year towards the basin rims, to 40 cm/1,000 year in the topographic lows of the basin center. The 'rain of sediment' process is ruled out as the principal deposition agent. The turbidity-current and normal-current hypotheses are briefly discussed as the most realistic alternatives. The lateral variations of the sedimentation rates are rather constant during the investigated time span, approaching 15,000 years. (Knapp-USGS)
W71-00368

BEACH CHANGES BY EXTRAORDINARY WAVES CAUSED BY HURRICANE CAMILLE,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Choule J. Sonu.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 35-45, Technical Report 77, February 1970. 11 p, 5 fig, 1 tab, 9 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Beach erosion, *Hurricanes, *Erosion, *Florida, Surges, Waves (Water), Currents (Water), Water levels, Storms, Damages, Floods, Geomorphology, Topography, Sands.
Identifiers: Ft. Walton (Fla), Hurricane Camille (1969).

Drastic erosion and swift recovery were the major characteristics of beach changes associated with Hurricane Camille at Fort Walton, Florida. Storm waves caused general erosion of the beach surface, and a scarp about 1 meter deep was produced about 40 meters behind the shoreline. After the hurricane, humps of sand in a train with regular spacing along the shore emerged in the surf zone bed. These were formed by longshore currents, which probably acted on large quantities of sand brought into the surf zone bed as a result of the preceding subaerial erosion. The humps subsequently moved shoreward and eventually climbed on the beach; a substantial part of the exposed beach volume was thus restored about a week after the hurricane. (Knapp-USGS)
W71-00380

EFFECTS OF HURRICANE CAMILLE ON THE LANDSCAPE OF THE BRETON-CHANDELEUR ISLAND CHAIN AND THE EASTERN PORTION OF THE LOWER MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright, F. J. Swaye, and J. M. Coleman.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 13-34, Technical Report 76, February 1970. 22 p, 17 fig, 16 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Hurricanes, *Erosion, *Beach erosion, *Louisiana, *Surges, Waves (Water), Currents (Water), Water levels, Storms, Damages, Floods, Geomorphology, Vegetation effects.
Identifiers: Hurricane Camille (1969).

Air and ground reconnaissance immediately following the passage of Hurricane Camille disclosed significant modifications to the natural landscape of the Breton-Chandeleur Island arc and to the eastern portion of the lower Mississippi Delta. Considerable dissection and redeposition was evident along beach and barrier formations, and total obliteration dominated numerous sections. Trends of redistributed beach material strongly reflected the final direction of hurricane-induced mass transport of water. In the lower delta damage was mainly to marsh vegetation and was attributable to high water and surge currents directed almost entirely from north to south. (Knapp-USGS)
W71-00381

PATTERN FORMING FORCES IN DELTAS,
Asian Inst. of Tech., Bangkok (Thailand).
Catalino del Rosario dela Cruz.
M.Eng. Thesis No 275, Asian Institute of Technology, 1970. 80 p, 48 fig, 5 tab, 60 ref, 3 append.

Descriptors: *Deltas, *Geomorphology, *Sedimentation, Sediment transport, Sediment yield, Provenance, Ocean water, Ocean waves, Waves (Water), Currents (Water), Streamflow, Salinity, Rainfall, Runoff, Statistical methods, Regression analysis, Data collections.
Identifiers: Delta formation.

Patterns and the causative independent variables of delta formation include river, ocean, and climatic forces. The river variables include mean annual discharge, sediment yield and river slope to the sea. Ocean variables consist of continental shelf characteristics, including width, depth of edge, bed slope, sea and swell waves duration, swell direction, and salinity. Climatic elements are temperature and rainfall. Regression analysis was used in obtaining predictive equations for discharge and sediment yield as a function of catchment characteristics. From the chosen variables, the following showed best correlation: mean annual rainfall and area for the discharge; and percentage of mountainous area, relief, area, and perimeter for the sediment yield. A similar regression analysis was applied to determine the relative influence of delta producing variables. Among the selected delta features, the following gave good correlations with the independent variables: apex-to-sea length, area, maximum width, maximum width to number of mouth ratio, ratio of maximum width to total number of distributaries, topography and side topography. (Knapp-USGS)
W71-00384

PORE FLUIDS OF RECENT MARINE SEDIMENTS: 1. OXIDIZING SEDIMENTS OF 20 DEGREES N, CONTINENTAL RISE TO MID-ATLANTIC RIDGE,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02K.
W71-00386

SOURCE AND DISPERSION OF SURFACE SEDIMENTS IN THE GULF OF MAINE--GEORGES BANK AREA,
Woods Hole Oceanographic Institution, Mass.
David A. Ross.
Supported by US Geological Survey, Washington, D.C. Journal of Sedimentary Petrology, Vol 40, No 3, p 906-920, September 1970. 15 p, 7 fig, 4 tab, 25 ref.

Descriptors: *Sedimentation, *Maine, *Continental shelf, *Bottom sediments, *Provenance, Sediment transport, Erosion, Glacial drift, Mineralogy, Sands, Tracking techniques, Sampling, Dispersion.
Identifiers: Gulf of Maine, Georges Bank.

A study of mineral composition of the sand fraction (2 to 0.062 mm) of 115 surface samples from the Gulf of Maine--Georges Bank area defined eight provinces based on heavy mineral composition. Sediments in three provinces, off the Penobscot, Kennebec, and Merrimack Rivers, are of recent origin. The remaining five provinces are composed of relict sediments of which three are of glacial origin. Sediments of Georges Bank are reworked from the Coastal Plain. Fine-grained sediments were winnowed from Georges Bank and transported into the Gulf of Maine where they are mixed with glacial sediments. Mineral composition

throughout the area of study is controlled mainly by the source. This modification is most pronounced in the high energy areas of Georges Bank and off Cape Cod, where more resistant heavy minerals predominate. The sediments in these areas are also better sorted and have lower feldspar--quartz ratios than the sediments in the low energy areas of the Gulf of Maine. (Knapp-USGS)
W71-00387

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM SEDIMENTS OF LAGOONAL, DELTAIC, RIVER, ESTUARINE, AND SALT WATER MARSH AND COVE ENVIRONMENTS,
Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-00388

REPEATABILITY OF THREE INSTRUMENTS USED TO DETERMINE THE UNDRAINED SHEAR STRENGTH OF EXTREMELY WEAK, SATURATED, COHESIVE SEDIMENTS,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-00389

TURBID BOTTOM WATER ON THE CONTINENTAL SHELF OF THE NORTHERN BERING SEA,
Washington Univ., Seattle. Dept. of Oceanography.
Dean A. McManus, and C. Stephen Smyth.
Journal of Sedimentary Petrology, Vol 40, No 3, p 869-873, September 1970. 5 p, 3 fig, 9 ref. USGS Contract No 14-08-0001-10924.

Descriptors: *Sediment transport, *Continental shelf, *Alaska, Silts, Currents (Water), Turbidity, Mineralogy, Pertide size, Sampling, Sedimentation, Suspended load, Bed load, Bottom sediments.
Identifiers: *Bering Sea.

In July 1968, the bottom water on the continental shelf of the northern Bering Sea contained concentrations of suspended material in excess of 2 ppm. Near the Alaska mainland, concentrations were as much as fivefold greater. The material is 85 percent mineral grains and has a modal particle size of 20 microns. Because of the net northward movement of the water through Bering Strait into the Chukchi Sea, the bottom water with its high silt concentration appears to be an important transport mechanism for supplying modern silt to the shelf in the Chukchi Sea. (Knapp-USGS)
W71-00390

THE LATERIAL DISTRIBUTION OF CLAY MINERALS IN LAKES PONTCHARTRAIN AND MAUREPAS, LOUISIANA,
Louisiana State Univ., Baton Rouge. Dept. of Geology.
Robert A. Brooks, and Ray E. Ferrell, Jr.
Journal of Sedimentary Petrology, Vol 40, No 3, p 855-863, September 1970. 9 p, 10 fig, 2 tab, 18 ref. OWRR Project A-007-LA.

Descriptors: *Clay minerals, *Clays, *Brackish water, *Water chemistry, *Sedimentation, Louisiana, Lakes, Deposition (Sediments), Flocculation, Kaolinite, Montmorillonite, Illite, Salinity, Saline water systems.
Identifiers: Lake Pontchartrain (La), Lake Maurepas (La).

Lakes Pontchartrain and Maurepas, Louisiana, are large bodies of brackish water. Water chemistry influences the lateral distribution of clay minerals. The water level in the lake system fluctuates rapidly, and as a result, the salinity of any given area is quite variable over a given period of time. However, the trends of the ionic gradients are fairly constant. Clay minerals flocculate and settle in consistent patterns in response to these compositional gradients. Kaolinite flocculates and settles in areas of lowest salinity. Montmorillonite has its greatest concentration in the higher salinity portions of the lake and is the most resistant to settling. Illite also appears to be concentrated in the sediments of the higher salinity areas. The K:H and Na:H ratios in the more saline portions of the lake approach the ratios, which define the hydrochemical stability field of K-mica, and suggest that Illite may be formed as an alteration product of other clay material. (Knapp-USGS)
W71-00391

SEDIMENT PROBLEMS IN URBAN AREAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04C.
W71-00393

THE RELATIONSHIP BETWEEN WATERSHED GEOLOGY AND BEACH RADIOACTIVITY,
California Univ., Berkeley. Hydraulic Engineering Lab.
John R. Byerly.
Available from NTIS as AD-420425, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No. 135, August 1963. 32 p.
Identifiers: Hydrology, California, *Beaches, Radioactivity, *Gamma ray spectroscopy, Analysis, Minerals, Geochemistry, Igneous rock, Radiochemistry, Decay schemes, Thorium, Uranium, Decay schemes, Sedimentary rock, Watersheds, Santa Cruz (California).

A correlation between the watershed geology of the Ben Lomend Mountain area north of Santa Cruz, California, and the radioactivity of the beaches receiving sediment from the watershed has been attempted. The radioactivity of stream and littoral sediments have been presented in terms of concentration of thorium as determined by gamma-ray spectroscopy. The results have not shed any light on the watershed geology-beach radioactivity relationship as the area of study failed to produce a radiometric anomaly of sufficient magnitude to be reflected in the littoral sediment. The resluts do show considerable variation in the thorium content of the stream sediment but the variation is not consistent with any known geological variation.
W71-00453

SPECIFIC GRAVITY DETERMINATION OF MARINE SEDIMENTS,
Naval Postgraduate School, Monterey, Calif.
Joseph C. Henderson.
Available from NTIS as AD-706 731, $3.00 in paper copy, $0.95 in microfiche. MS Thesis, April 1970. 124 p.
Identifiers: *Ocean bottom, Density, *Specific gravity, Densimeters, Kaolinite, Montmorillonite, Colloids, Test methods, Quartz, Theses, Naval research.

Accurate specific gravity measurements are required for the analysis of physical properties of marine sediments. Application of the bottle pycnometer technique, the standard determination method, is time-consuming, tedious, and perhaps subject to inaccuracies in the case of fine particulate matter. A review of methods currently in use was conducted to ascertain the present state of the art and reveal any new developments in this field. Specific gravity values for three operating modes of the air comparison pycnometer, two of which use helium, were compared with bottle pycnometer values for four test materials. The air comparison pycnometer determinations, regardless of operating mode, resulted in higher specific gravities than their counterpart bottle pycnometer values for kaolinite, montmorillonite, and marine sediment samples. The use of helium as the comparison medium in the air comparison pycnometer appears to reduce the surface active characteristics of the colloidal material. Specific gravity determinations by all four test methods agreed very well for powdered quartz samples with a known specific gravity.
W71-00461

2K. Chemical Processes

A STUDY OF GROUNDWATER POLLUTION BY SALT.
For primary bibliographic entry see Field 05B.
W71-00001

SEA WATER,
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 01B.
W71-00008

SEDIMENT-SEAWATER INTERACTION IN GLACIOMARINE SEDIEMENTS OF SOUTHEAST ALASKA,
Alaska Univ., College. Inst. of Marine Science.
Ghanshyam D. Sharma.
Geological Society of America Bulletin, Vol 81, No 4, p 1097-1105, April 1970. 9 p, 14 fig, 1 tab, 15 ref. AEC Grant No AT (04-3)-310; NSF Grant No GP 5115.

Descriptors: *Water chemistry, *Connate water, *Sediments, *Alaska, *Glacial drift, Sea water, Clay minerals, Chemical reactions, Geochemistry, Saline water systems, Ion exchange, Ion transport, Glaciers.
Identifiers: Glaciomarine sediments.

The chemical composition of interstitial waters and the mineralogy of recent glaciomarine sediments from southeast Alaska were determined to study the interaction between sediments and sea water. Differences in chemical composition of overlying and interstial waters of bottom sediments reflected the nature and extent of sediment-sea water interaction. Such interaction depends on bulk mineralogy and particle size of sediments, evironment of deposition, and path length the sediments follow prior to deposition. During transport and early stages of burial, cation exchange is the major process responsible for changes in the composition of interstitial water and sediments. Analyses of interstitial waters of cores indicated maximum variations with depth in sodium ion concentration, followed by calcium and magnesium ion concentrations. (Knapp-USGS)
W71-00027

RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
For primary bibliographic entry see Field 01B.
W71-00040

THE EFFECTS OF VELOCITY ON THE PASSIVATION OF ALLOYS IN BRACKISH WATER,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 03A.
W71-00064

EVIDENCE OF DIURNAL MINERAL VARIATIONS OF CERTAIN CHEMICAL FACTORS IN MOUNTAIN STREAMS AS INFLUENCED BY BENTHIC ORGANISMS (IN FRENCH),
Bernard Serra-Tosio.
Comptes Rendus Academie des Sciences, Paris, Vol 269, No 24, Serie D, p 2431-2434, 1969. 2 fig, 3 ref.

Descriptors: *Chemical properties, *Diurnal distribution, *Fluctuations, *Streams, Sampling, Phytoplankton, Aquatic organisms, Diatoms, Absorption, Biochemistry, Metabolism, Volumetric analysis.
Identifiers: *Mountain streams, Water chemical variations, Furon River (France), Bourne River (France), Hydrotitrometric degree.

Determination of total oxygen, pH, and contents of oxygen, silica, nitrates, phosphates, Sulfates, Total

alkalinity, and titration value in water of two mountain streams were performed at 4-hour intervals during June, July, and September. With the exception of sulfates, the results showed a diurnal variation of analysed factors, correlated with the time of water sampling and activity of phytobenthic and phytoplanktonic organisms. The supply of oxygen and most of mineral nutrients was depleted during the daytime hours, whereas the supply of phosphates was depleted during the nights. (Wilde-Wisconsin)
W71-00097

INFLUENCE OF ARSENIC OXIDE IONS ON THE ABSORPTION OF PHOSPHATE IONS BY CHLORELLA (IN FRENCH),
Centre Universitaire de Luminy, Marseille (France).
Robert Jeanjean, and Francis Blasco.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 15, Serie D, p 1897-1900, 1970. 5 fig, 9 ref.

Descriptors: *Algae, *Chlorella, *Absorption, *Phosphate, Inhibition, Kinetics, Phosphorus radioisotopes, Analytical techniques, Arsenic compounds.
Identifiers: *Arsenic oxide, Geiger counter, Michaelis-Menten method, Liquid scintillation.

The effect of arsenic oxide on absorption of labeled phosphorus by Chlorella was determined by measuring the radioactivity of cultured algae with a Geiger counter, or by liquid scintillation. The results showed that arsenic oxide, structurally analogous to phosphate, acts as a competitive inhibitor in the absorption of phosphorus, the inhibition being in principle a reversible process. The rate of absorption is a function of time and the concentration of both antagonists. (Wilde-Wisconsin)
W71-00102

PHYTOPLANKTON, PHOTOSYNTHESIS, AND PHOSPHORUS IN LAKE MINNETONKA, MINNESOTA,
Minnesota Univ., Minneapolis. Limnological Research Center.
Robert O. Megard.
Minnesota State Pollution Control Agency PRO-912-MNN. Contribution no 90, Limnological Research Center, 1970. 45 p, 20 fig, 10 tab, 30 ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Phosphorus, *Minnesota, Light intensity, Seasonal, Algae, Nitrogen fixation, Chlorophyll, Mathematical models, Primary productivity, Temperature, Depth, Eutrophication, Nitrogen, Sewage effluents, Oxygen, Water chemistry, Alkalinity, Hydrogen ion concentration, Sediments, Density, Cyanophyta, Chrysophyta, Chlorophyta, Pyrrophyta, Euglenophyta, Remote sensing, Minnesota.
Identifiers: *Lake Minnetonka (Minn), Asterionella, Anabaena, Morphometry, Cryptophyta, Peridiniales, Cryptomonadales, Desmidiales, Chlorococcales, Volvocales, Pennales, Centrales, Chroococcales, Hormogonales.

The relationships among phytoplankton population densities, light attenuation, and integral photosynthesis are used as basis for a model of the planktonic photosynthetic system. Total photosynthesis beneath a unit of water surface (integral photosynthesis) is estimated from the phytoplankton density and the photosynthetic rate at optimal illumination. Analysis of the phosphorus budget indicates that phosphorus is deposited in sediments soon after it enters the lake (Minnetonka). Net rate of phosphorus deposition is similar to rate of influx from the watershed. There is no relationship between phosphorus and photosynthesis during spring and autumn, when phosphorus concentrations are highest, but photosynthesis is closely related to concentrations of total phosphorus during summer when the dominant algae are species able to fix nitrogen. Phytoplankton never fully utilize phosphorus concentrations exceeding 100 milligrams/cubic meter, because population density and resultant shading, limits integral photosynthesis. Nuisance algal blooms can be quickly reduced by controlling phosphorus influx. The model suggests that integral photosynthesis increases linearly as chlorophyll concentrations increase to 16 milligrams/cubic meter and provides a basis for estimating primary productivity of large water bodies from remotely sensed chlorophyll concentrations and temperature measurements. (Jones-Wisconsin)
W71-00108

CONDENSED PHOSPHATES IN LAKE WATER AND WASTE WATER,
Toronto Univ. (Ontario). Dept. of Civil Engineering; and McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
G. W. Heinke, and J. D. Norman.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 6 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Phosphates, *Lakes, *Waste water (Pollution), *Hydrolysis, Detergents, Great Lakes, Temperature, Hydrogen ion concentration, Activated sludge, Treatment, Eutrophication, Surfactants, Enzymes, Lake Ontario, Seasonal, Algae, Cultures, Microorganisms, Effluents, Settling basins, Waste water treatment, Laboratory tests.
Identifiers: *Condensed phosphates, Sodium tripolyphosphate, Sodium pyrophosphate.

Hydrolysis rate of sodium tripolyphosphate and sodium pyrophosphate in Great Lakes water and waste water under conditions of temperature, pH and concentration occurring in the environment are evaluated. Condensed phosphates from detergents are major phosphorus contributors to waste water--about double the human waste contribution in the United States and about equal to it in Canada. Condensed phosphates hydrolyze extensively during activated sludge treatment, with about 15% remaining in the effluent, hydrolyzing in waste water three times faster in summer than winter. Once discharged to surface waters, hydrolysis proceeds at a much slower rate, depending on the extent of microbial activity in the surface water. Studies on the effect of pH changes show fastest rates of hydrolysis occurring at the natural pH of waste water or lake water. Experimental data at low levels of concentration, below 15 milligrams/liter phosphates, are best fitted by a zero-order model. A graphical presentation allows an order of magnitude prediction of hydrolysis rate to be expected in a particular situation. Results of this work are of value in research on phosphorus removal methods and eutrophication studies. (Jones-Wisconsin)
W71-00116

QUALITY AND SEASONAL FLUCTUATION OF HEADWATER STREAMS IN MONTANA,
Montana Forest and Conservation Experiment Station, Missoula.
For primary bibliographic entry see Field 05A.
W71-00142

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY,
Eastman Kodak Co., Rochester, N.Y.
For primary bibliographic entry see Field 05A.
W71-00168

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY - USE OF G.E. GERMICIDAL ULTRAVIOLET INTENSITY METER,
Eastman Kodak Co., Rochester, N.Y.
For primary bibliographic entry see Field 05A.
W71-00169

PHOTOMETRIC MERCURY ANALYSIS - CORRECTION FOR ORGANIC SUBSTANCES,
Eastman Kodak Co., Rochester, N.Y. Research Labs.
For primary bibliographic entry see Field 05A.
W71-00170

SENSITIVE SIMPLE MERCURY PHOTOMETER USING MERCURY RESONANCE LAMP AS A MONOCHROMATIC SOURCE,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
For primary bibliographic entry see Field 05A.
W71-00171

PORTABLE ATOMIC ABSORPTION PHOTOMETER FOR DETERMINING NANOGRAM QUANTITIES OF MERCURY IN THE PRESENCE OF INTERFERING SUBSTANCES,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
For primary bibliographic entry see Field 05A.
W71-00172

NATURAL ORGANIC ACIDS AS AGENTS OF CHEMICAL WEATHERING,
Geological Survey, Denver, Colo.; and Colorado School of Mines, Golden. Dept. of Chemistry.
H. Ling Ong, Vernon E. Swanson, and Ramon E. Bisque.
Chapter C for sale by the Superintendent of Documents, US Gov't Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Professional Paper 700-C, p C130 - C137, 1970. 8 p, 6 fig, 1 tab, 40 ref. USGS Grant No. 14-08-001-6-12.

Descriptors: *Weathering, *Humic acids, *Soil formation, Leaching, Mineralogy, Soil chemistry, Water chemistry, Ion transport, Ion exchange.
Identifiers: Chemical weathering.

Naturally occurring organic acids, commonly called 'humic acids,' are effective agents in the colloidal transport of copper, lead, zinc, iron, and alluminum. Concentrations of organic acids in the range of 4-40 ppm carbon in water can effect increases of several orders of magnitude in the amount of these metals 'stabilized' in solution. Stability of these metal-organic colloids increases with increasing organic acid concentration and increasing pH. The optimum condition for the stability, in general, lies between pH 6 and pH 9. Chemical weathering due to differential leaching of cations by organic acids may be largely responsible for the formation of sedimentary aluminum and lateritic deposits, which are restricted to tropical and subtropical regions where organic acids are abundant. (Knapp-USGS)
W71-00174

THE USE OF AUTOMATED TITRIMETRY FOR ANALYSES OF NATURAL WATER,
Geological Survey, Denver, Colo.; and Geological Survey, Oklahoma City, Okla.
Marvin J. Fishman, and Ralph F. Pascoe.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C222-C225, 1970. 4 p, 4 fig, 2 tab, 2 ref.

Descriptors: *Water analysis, *Automation, *Volumetric analysis, Water chemistry, Alkalinity, Chlorides, Sulfates, Analytical techniques, Chemical analysis, Laboratory tests.
Identifiers: Automated titrimetry.

Automated titrimetric analysis was applied to the determination of alkalinity, chloride, and sulfate in fresh water. Replicate analyses and comparison of results with those obtained by similar manual titration methods show that automated titrimetric methods are accurate and reproducible, and pro-

vide a rapid means for the determination of these substances in water. (Knapp-USGS)
W71-00183

AUTOMATED POTENTIOMETRIC DETERMINATION OF CHLORIDE IN WATER,
Geological Survey, Denver, Colo.
Marvin J. Fishman, and Oliver J. Feist, Jr.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C226-C228, 1970. 3 p, 2 fig, 2 tab, 4 ref.

Descriptors: *Water analysis, *Automation, *Volumetric analysis, Chemical analysis, Water chemistry, Chlorides, Analytical techniques, Laboratory tests.
Identifiers: Potentiometric analysis.

Chloride is determined with standard silver nitrate solution by automated potentiometric titration using chloride ion-selective and reference electrodes. Replicate analyses and comparison of results with those obtained by other automated methods show that the automated potentiometric method is as accurate and reproducible as other methods, and provides a rapid means for the determination of chloride in water. (Knapp-USGS)
W71-00184

GEOLOGY, MINERAL DEPOSITS, AND GEOCHEMICAL AND RADIOMETRIC ANOMALIES, SERPENTINE HOT SPRINGS AREA, SEWARD PENINSULA, ALASKA,
Geological Survey, Washington, D.C.
C. L. Sainsbury, Travis Hudson, Reuben Kachadoorian, and Thomas Richards.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, D.C. Geological Survey Bulletin 1312-H, 1970. 19 p, 2 fig, 1 plate, 4 tab, 12 ref.

Descriptors: *Geochemistry, *Exploration, *Surveys, *Sampling, Data collections, Trace elements, Investigations, Placer mining, Sediments, Faults (Geology), Mineralogy.
Identifiers: Geochemical prospecting.

Geologic mapping, analyses of samples of bedrock, and geochemical studies have disclosed the probable source of placer gold and tin on Humboldt Creek, Serpentine-Kougarok area, Alaska, and have shown mineralized bedrock in several areas on the east side of the granite stock at Serpentine Hot Springs. Gold, silver, mercury, arsenic, cobalt, copper, molybdenum, nickel, lead, antimony, tin, tungsten, and zinc occur in panned stream concentrates and in altered bedrock that is associated with steep faults, thrust faults, and quartz veins. Two mineralized and altered fault zones were sampled in detail; one contains float fragments of highly argentiferous galena (as much as 5,000 parts per million Ag). Anomalous amounts of metal in bedrock samples, in stream sediments, and in panned concentrates from stream sediments and rock samples suggest areas of mineralized bedrock outside the granite; radiometric anomalies lie within the granite and near the contact of the granite but have not been evaluated on the ground. (Knapp-USGS)
W71-00203

SILICATE MINERAL STABILITY AND MINERAL EQUILIBRIA IN THE GREAT LAKES,
Syracuse Univ., N.Y. Dept. of Geology.
For primary bibliographic entry see Field 02H.
W71-00204

ELECTRODIALYSIS OF ESTUARINE WATER,
Metcalf and Eddy, N.Y.
For primary bibliographic entry see Field 05D.
W71-00214

DETERMINATION OF SUBMICROGRAM QUANTITIES OF MERCURY IN LAKE WATERS,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland Waters.
For primary bibliographic entry see Field 05A.
W71-00355

GEOTHERMAL WASTES AND THE WATER RESOURCES OF THE SALTON SEA AREA,
California State Dept. of Water Resources, Sacramento.
Sanford L. Werner, and Larry J. Olson.
Copies of report may be obtained from Office of Procurement, Documents Section, PO Box 20191, Sacramento, Calif. 95820--Price $3.50. California Department of Water Resources Bulletin No 143-7, February 1970. 123 p, 10 fig, 2 plate, 14 tab, 121 ref, 7 append.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Geothermal studies, Waste storage, Water quality, Chemical analysis, Salinity, Trace elements, Radiochemical analysis, Hydrology, Climatic data, Streamflow, Irrigation, Geology, Recreation facilities.
Identifiers: Lake inflow, Imported water, Mud volcanoes.

Data and information derived from previous studies and from investigations in the field concerning water resources and geothermal wastes of the Salton Sea Area in California are evaluated. To date, the development of the geothermal resources in the Salton Sea Area has been centered in the Buttes thermal area, southeast of the Salton Sea, involving the drilling of 15 geothermal wells. Development of geothermal resources in the Salton Sea Area has been hindered considerably by the lack of available disposal sites for brine, bittern wastes, and accumulated salt deposits. Moreover, the highly saline brine has caused operational problems. Estimated heat content of the Salton Sea geothermal reservoir (Buttes thermal area) is a minimum of 2x10 to the 19th power calories. That estimate was based on an underlying geothermal reservoir which was assumed to be equivalent to a cylinder 7 km in diameter, 3 km in thickness, having an average temperature of 250 deg C, and an average volumetric specific heat of 0.7 cal/cu cm. The Salton Sea is the largest body of water in California. The total value of physical investments related to the Sea is in the order of $900 million. The Sea's salinity is about 36,000 ppm--slightly more saline than the oceans--and it is increasing; and this increase could be accelerated by the discharge of the still saltier geothermal wastes. Maps, pictures, and tables of data are included. (Woodard-USGS)
W71-00356

SOME GEOLOGICAL CHARACTERISTICS OF SEDIMENTS FROM THE NORTH ATLANTIC OCEAN,
Utrecht Rijksuniversiteit (Netherlands). Vening Meinesz Lab. for Geophysics and Geochemistry.
For primary bibliographic entry see Field 02J.
W71-00362

SOME ASPECTS OF THE DISTRIBUTION, CHEMISTRY, AND MINERALOGY OF SUSPENDED MATTER IN THE GULF OF MAINE,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
Derek W. Spencer, and Peter L. Sachs.
Marine Geology, Vol 9, No 2, p 117-136, September 1970. 20 p, 8 fig, 7 tab, 22 ref, append.

Descriptors: *Water chemistry, *Clay minerals, *Solutes, *Suspended load, *Sea water, Mineralogy, Geochemistry, Sampling, Water analysis, Clays, Particle size, Chemical analysis.
Identifiers: Gulf of Maine.

Suspended matter in the Gulf of Maine decreases from the surface to about 50 m and then increases exponentially as the bottom is approached. From 50 m down, the suspended matter is dominantly layer silicates which are interpreted as resuspended bottom material. In the upper 50 m particulate phosphorus, copper, and zinc occur principally in organism. There is, however, little evidence that significant amounts of these elements are reaching the bottom in an organic particulate form, and most appear to be regenerated in the water column. The distributions of particulate Al and Fe are controlled largely by the suspended silicates, and there is no evidence that a free ferric hydroxide phase is important. (Knapp-USGS)
W71-00364

THE NUTRIENT CYCLES OF AN ECOSYSTEM,
Forest Service (USDA), Laconia, N.H. Hubbard Brook Experimental Forest.
F. Herbert Bormann, and Gene E. Likens.
Scientific American, Vol 223, No 4, p 92-101, October 1970. 10 p, 10 fig.

Descriptors: *Nutrients, *Hydrologic budget, *Small watersheds, *Forests, *Cycling nutrients, Ecology, Leaching, Forest management, Clearcutting, Water yield, Energy budget, Food chains, Water chemistry.
Identifiers: Nutrient budget, Nutrient cycle, Forested watersheds, Hubbard Brook Experimental Watershed.

Both hydrologic and nutrient budgets were determined in undisturbed and in devegetated watersheds at Hubbard Brook Experimental Watershed, New Hampshire. The forest has been undisturbed by cutting or fire since 1919. Average annual precipitation is 123 centimeters and runoff is 72 centimeters, with evapotranspiration averaging 51 centimeters. Most of the runoff (57%) occurs during the snowmelt period of March, April and May. The concentrations of potassium, calcium and magnesium hardly change with runoff volume, and the concentration of sodium decreases by only 3 times as the discharge rate increases by 4 orders of magnitude. All these relations show how strongly stream-water chemistry is under the control of processes inherent in the forest ecosystem. The total output of elements is strongly dependent on the volume of stream flow. Deforestation had a pronounced effect on runoff. Treatment also resulted in a fundamental alteration of the nitrogen cycle, which in turn caused extraordinary losses of soil fertility. The capacity of the ecosystem to retain nutrients is dependent on the maintenance of nutrient cycling within the system. When the cycle is broken, as by the destruction of vegetation, the loss of nutrients is greatly accelerated. (Knapp-USGS)
W71-00374

PORE FLUIDS OF RECENT MARINE SEDIMENTS: 1. OXIDIZING SEDIMENTS OF 20 DEGREES N, CONTINENTAL RISE TO MID-ATLANTIC RIDGE,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
James L. Bischoff, and Teh-Lung Ku.
Journal of Sedimentary Petrology, Vol 40, No 3, p 960-972, September 1970. 13 p, 2 fig, 3 tab, 56 ref.
NSF Grant GA 1419.

Descriptors: *Water chemistry, *Connate water, *Atlantic Ocean, *Ion exchange, *Clay minerals, Sea water, Membrane processes, Mass transfer, Thermal water, Mineralogy, Chemical reactions, Sampling, Bottom sediments, Sedimentation.
Identifiers: Mid-Atlantic Ridge.

Pore fluids were extracted on shipboard from 12 deep-sea sediment cores taken during an east to west traverse from Africa to the Mid-Atlantic Ridge, between latitudes 18 deg N and 20 deg N. They were analyzed for Cl, SO4, Mg, Ca, K, Sr, SiO2, B, Li, and Mn. Excepting Cl, SO4, and Ca, which are very close to sea water composition, other components examined are slightly but systematically different from normal sea water. Con-

stancy of Cl in samples of varying clay: $CaCO_3$ ratios negate semipermeable membrane behavior of compacting clays, at least for the top 10 meters of sediment. K and B enrichments mirrored by Mg depletions suggest authigenic chlorite formation at the expense of illite K-feldspar and perhaps montmorillonite. The rather constant SiO_2 level and its enrichment over that of bottom water appear indicative of control by clay-silica equilibria. Minor variations of all elements along depths of cores become magnified and more erratic in the Ridge area, due to heterogeneity of mineralogy or perhaps local hydrothermal effects. (Knapp-USGS)
W71-00386

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM SEDIMENTS OF LAGOONAL, DELTAIC, RIVER, ESTUARINE, AND SALT WATER MARSH AND COVE ENVIRONMENTS,
Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
Gerald M. Friedman, and Eliezer Gavish.
Journal of Sedimentary Petrology, Vol 40, No 3, p 930-953, September 1970. 24 p, 43 fig, 2 tab.

Descriptors: *Water chemistry, *Connate water, *Bottom sediments, *Estuaries, Marshes, Lagoons, Brackish water, Saline water systems, Sedimentation, Ion exchange, Clay minerals, Hydrogen ion concentration, Oxidation-reduction potential.
Identifiers: Long Island (NY), Great South Bay (NY).

The chemical characteristics of interstitial waters of sediments of lagoonal, deltaic, river, estuarine, and salt water marsh and cove environments were studied. The chemical characteristics of surface, bottom, and interstitial waters were compared at each core station; in many cores, changes within the sediment profile were also measured. The pH and Eh were measured in surface and bottom waters and at intervals along the core. Values of pH and Eh are lower in interstitial waters than in the overlying waters. In lagoonal and river delta cores, and at the mouth of the river estuary, the chlorinity is higher in interstitial waters. In the river estuary, the chlorinity in the interstitial waters is lower. Biological processes are responsible for the decreases in pH and Eh. Increase in the Ca/Cl ratio and decreases in the ratio of cations to Cl depend on the interaction between clay minerals and water, particularly on cation exchange. (Knapp-USGS)
W71-00388

EFFECTS OF ZOOPLANKTON ON PHOTOSYNTHESIS BY ALGAE IN LAKES,
Richmond Univ., Va. Dept. of Biology.
For primary bibliographic entry see Field 02H.
W71-00416

AUTOMATED POTENTIOMETRIC TECHNIQUES FOR THE ON-SITE MONITORING OF ION CONCENTRATIONS IN WATER,
Missouri Univ., Columbia. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W71-00474

2L. Estuaries

UNSTEADY FLOW IN CHANNEL OF VARIABLE CROSS SECTION,
University of Strathclyde, Glasgow (Scotland).
John Ellis.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7583, p 1927-1945, October 1970. 19 p, 12 fig, 2 tab, 13 ref, append.

Descriptors: *Estuaries, *Currents (Water), *Unsteady flow, *Tidal effects, *Mathematical models, Computer programs, Model studies, Hydraulics, Inlets (Waterways), Open channel flow, Tides.
Identifiers: Irregular channels.

Characteristic equations describing one-dimensional unsteady open-channel flow in an irregular channel are developed. The integration of these characteristic equations is presented and methods of approximation for the evaluation of the integrals involved in these characteristic equations are considered. The most promising of these numerical integration techniques are incorporated in computer procedures which are linked to form a complete program. This program is used in the modelling of the tidal motion in an inlet of the sea. The particular inlet chosen was one which contained large changes of cross-sectional shape along its length. The varying geometrical properties of the inlet, along its length, are included in the analysis by the preparation of tables of section properties with water level for a series of cross sections. This information is read into the computer at the start of computations. Comparisons are made between computed water levels and actual field records. (Knapp-USGS)
W71-00023

EVIDENCE OF SEAWATER ENRICHMENT BY INFLUX OF SUSPENDED MINERALS FROM FRESH WATER. EXAMPLE THE RHONE (IN FRENCH),
Centre Universitaire de Luminy, Marseille (France). Laboratoire d'Hydrobiologie Marine.
Francois Blanc, Herve Chamley, and Michel Leveau.
Comptes Rendus Academie des Sciences, Paris, Vol 269, No 25, Serie D, p 2509-2512, 1969. 1 fig, 7 ref.

Descriptors: *Saline water-freshwater interfaces, Nutrients, Sea water, Rivers, Seston, Saline water, Illite, Chlorides, Calcium, Watersheds, Quartz, Analytical techniques, X-ray analysis, Precipitation (Atmospheric), Erosion.
Identifiers: Rhone River (France), Minerals, Feldspar.

The progression of the surface water of the River Rhone into the sea was established on the basis of the presence of seston and mineral constituents and a comparison of water salinity. The enrichment of sea water in solids and the decrease in concentration of salts reflected meteorologic conditions and the resulting degree of perturbation of the surrounding uplands. (Wilde-Wisconsin)
W71-00100

THE BENTHIC COMMUNITIES OF LOOSE SUBSTRATA OF THE CONTINENTAL PLATEAU IN THE VICINITY OF THE BANYULS-SUR-MER (IN FRENCH),
Alain Guille.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 6, Serie D, p 189-192, 1970. 1 fig, 1 tab, 9 ref.

Descriptors: *Benthic fauna, *Biological communities, *Distribution patterns, Sands, Gravels, Biomass.
Identifiers: Spisula, Branchiostoma, Amphiura, Nephthys, Venus, Nucula, Scoloplos, Auchenoplax, Catalonian shores (France), Substrate, Subirrigated sands, Infralittoral floors, Circalittoral floors.

The dense network of dredging stations on the Catalonia shore of France led to rediscovery of the biocoenotic relationships of the benthic fauna. The boundaries of the three principal communities are delineated by the nature of the deposits: Spisula subtruncata with multitude of mollusks, confined to fine sands, Branchiostoma lanceolatum of coarse sands and fine gravel, and Amphiura filiformis occupying near-littoral floors. These major associations exhibit a number of subcommunities and still smaller divisions, called facies. Estimates for each community include their area in square kilometers, number of species and specimens per square meter, and biomass in gram/square meter. The obtained results are comparable to some other marine sites such as that of La Manche. As suggested, the general notion about poverty of the Mediterranean benthos must be revised with respect to certain sections. (Wilde-Wisconsin)
W71-00105

WAVE-HEIGHT PREDICTION FOR WAVE GENERATORS IN SHALLOW WATER,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 08B.
W71-00143

NOTES ON THE POSITION OF A PHOSPHATE ZONE AND ITS RELATION TO GROUNDWATER IN COASTAL GEORGIA,
Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 02F.
W71-00178

TIDAL STUDY OF THREE OREGON ESTUARIES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
C. R. Goodwin, E. W. Emmett, and Bard Glenne.
Oregon State University Engineering Experiment Station Bulletin No 45, May 1970. 39 p, 17 fig, 5 tab, 21 ref, append. NSF Grant GH-45.

Descriptors: *Estuaries, *Oregon, *Currents (Water), *Tides, Water circulation, Data collections, Hydrologic data, Stratification, Streamflow, Water quality, Water resources development, Water management (Applied), Water levels, Stream gages, Tidal effects.
Identifiers: Yaquina estuary (Oregon), Alsea estuary (Oregon), Siletz estuary (Oregon).

The results of tidal measurements in the Yaquina, Alsea, and Siletz estuaries, Oregon are presented. Investigations of the tidal mechanisms in these estuaries show amplifications of the entrance tidal range throughout the Yaquina estuary. In the Alsea and Siletz estuaries a marked choking of the tidal range takes place through the entrance. In the Alsea the choking continues past Waldport before amplification of the tidal range occurs. A phase difference of 90-100 degrees is found to exist between tidal elevations and tidal currents in the three estuaries. This as well as amplification in the tidal range indicate the presence of reflected waves or resonance conditions. (Knapp-USGS)
W71-00205

LARGE SPRINGS OF FLORIDA'S 'SUN COAST,' CITRUS AND HERNANDO COUNTIES,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02F.
W71-00207

ELECTRODIALYSIS OF ESTUARINE WATER,
Metcalf and Eddy, N.Y.
For primary bibliographic entry see Field 05D.
W71-00214

EXTENT OF BRACKISH WATER IN THE TIDAL RIVERS OF MARYLAND,
Geological Survey, Towson,Md.
W. E. Webb, and S. G. Heidel.
Maryland Geological Survey Report of Investigations, No 13, 1970. 46 p, 18 fig, 12 tab, 32 ref, append.

Descriptors: *Saline water intrusion, *Estuaries, *Maryland, Tidal effects, Streamflow, Channel morphology, Water quality, Saline water, Salinity.
Identifiers: *Tidal rivers, *Extent of brackish water, Salt-water front.

Fresh-water discharge, tide height and estuary size, shape, and salinity at the mouth are important controls on the extent of brackish water in tidal rivers (estuaries) of Maryland. Long-term predictions of the frequency or times at which brackish water will

penetrate to a given section of an estuary are difficult because of the complex relations between the controls and the lack of quantitative predictions of the controls. Graphs and maps in the report show the historic extent of brackish water and may be used to estimate the probable extent of brackish water in the principal estuaries. For a distance of about 15 miles most of the estuaries will be brackish during one season, but will contain fresh water in the same section during another season of the year. In an estuary section containing a salt front, the water may be fresh at low tide but brackish at high tide. Extremes usually occur twice in 24 hours. The estuaries tributary to Cheaspeake Bay usually contain relatively fresh water for 10 to 30 miles downstream from the point where tidal effect ceases. Data show that brackish water is flushed downstream by a sudden increase in discharge for a length of channel which will accomodate the volume discharged. (Woodard-USGS)
W71-00215

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
For primary bibliographic entry see Field 05B.
W71-00231

STOCHASTIC ASPECTS OF LAKE ONTARIO EVAPORATION,
Rutgers - The State Univ., New Brunswick, N.J.
For primary bibliographic entry see Field 02D.
W71-00233

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
For primary bibliographic entry see Field 05B.
W71-00236

ESTUARY ENTRANCE UMPQUA RIVER, OREGON--HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-00308

SOME ASPECTS OF THE DISTRIBUTION, CHEMISTRY, AND MINERALOGY OF SUSPENDED MATTER IN THE GULF OF MAINE,
Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-00364

MAGNETIC FABRIC OF SEDIMENTS FROM THE SHELF AT LA JOLLA (CALIFORNIA),
Southampton Univ. (England).
For primary bibliographic entry see Field 02J.
W71-00367

PHYSICAL DATA OF POTOMAC RIVER TIDAL SYSTEM INCLUDING MATHEMATICAL MODEL SEGMENTATION,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05G.
W71-00375

EFFECTS OF HURRICANES CAMILLE AND LAURIE ON THE BARATARIA BAY ESTUARY,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Rodney Adams.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 47-52, February 1970. 6 p, 5 fig. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Beach erosion, *Hurricanes, *Surges, *Louisiana, *Estuaries, Waves (Water), Currents (Water), Water levels, Water level fluctuations, Floods, Damages, Geomorphology, Topography, Beaches, Deltas, Lakes.

The two late-season hurricanes, Camille and Laurie, passed to the east and south of the Barataria Bay estuary but did produce above-normal tides and accumulations of wind-driven debris. Maximum winds with Camille reached 45 to 65 miles per hour at Grand Isle and were from the east and north when the most severe effects were felt. Laurie shifted to an easterly course when she was still 175 miles south of Grand Isle, and no severe winds were experienced. Rapid water-level rise was accompanied by high winds from the east and northeast, which drove vast quantities of marsh grass debris against buildings and embankments. There were no significant changes to the shoreline from Southwest Pass to the mouth of Bayou Lafourche. However, aerial photographs taken immediately after the storm show what appears to be small washover fans to the east of Grand Isle on Grand Terre and Shell Island. (Knapp-USGS)
W71-00379

SOURCE AND DISPERSION OF SURFACE SEDIMENTS IN THE GULF OF MAINE--GEORGES BANK AREA,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02J.
W71-00387

CHEMICAL CHANGES IN INTERSTITIAL WATERS FROM SEDIMENTS OF LAGOONAL, DELTAIC, RIVER, ESTUARINE, AND SALT WATER MARSH AND COVE ENVIRONMENTS,
Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Geology; and Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-00388

TURBID BOTTOM WATER ON THE CONTINENTAL SHELF OF THE NORTHERN BERING SEA,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W71-00390

AN ECOLOGICAL SURVEY OF A SANDY BEACH,
Naval Postgraduate School, Monterey, Calif.
Thomas Joseph Berger.
Available from NTIS as AD-709 087, $3.00 in paper copy, $0.95 in microfiche. MS Thesis, April 1970. 42 p.
Identifiers: *Beaches, *Ecology, Environment, Sand, Grain size, Invertebrates, Tides, Annelida, Arthropods, Crustacea, Thesis, Nephtys caecoides, Nephtys californiensis, Archaeomysis maculata.

An ecological survey of a sandy beach was made to determine relationships between population densities and sand grain size distributions, season and height above the tidal datum plane (MLLW). Fifteen species of invertebrates in four phyla were collected. Four zones relative to tidal datum and two major habitats - protected outer coast sandy beach and outer coast sandy beach - were defined. Nephtys californiensis and Archaeomysis maculata showed distinctive distribution patterns relative to mean grain size which require further investigation.
W71-00418

TEXAS MARINE RESOURCES: THE LEISURE VIEW,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 06B.
W71-00438

WATER RESOURCES IN THE TAMPA BAY REGION OF FLORIDA: HILLSBOROUGH, PINELLAS, MANATEE AND SARASOTA COUNTIES.
Tampa Bay Regional Planning Council, St. Petersburg, Fla.

Available from NTIS as PB-192 410, $3.00 in paper copy, $0.95 in microfiche. Briley, Wild and Assoc., April 1970. 193p.
Identifiers: *Management planning, Florida, Water supplies, Natural resources, Statistical data, Housing, Industries, Recreation, Control, Wastes (Sanitary engineering), Storage, Rainfall, Agriculture, Statistical analysis, Storms, Salvage, *Tampa Bay Region (Florida), Hillsborough County (Florida), Pinellas County (Florida), *Manatee County (Florida), *Sarasota County (Florida), *Area planning, Development, *Wateruse.

The Report includes an inventory of the Region's total water resource; estimates of future water use requirements; recommendations for a continuing program for the development of alternative and supplemental water sources, and a recommended plan for the conservation, development and management of the Region's water resources.
W71-00447

THE RELATIONSHIP BETWEEN WATERSHED GEOLOGY AND BEACH RADIOACTIVITY,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02J.
W71-00453

INTERACTIONS OF THE BEACH-OCEAN-ATMOSPHERE SYSTEM AT VIRGINIA BEACH, VIRGINIA,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-00468

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

RADIATION-INDUCED PREPARATION OF METALS FROM THEIR AQUEOUS SALT SOLUTIONS,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
For primary bibliographic entry see Field 01B.
W71-00040

THE EFFECTS OF VELOCITY ON THE PASSIVATION OF ALLOYS IN BRACKISH WATER,
Denver Research Inst., Colo.
Donald F. Klodt.
Denver University, Denver Research Institute Final Report to Office of Saline Water, October 1968. 32 p, 16 fig, 3 tab, 3 ref. OSW Contract No 14-01-0001-1335.

Descriptors: *Corrosion, *Desalination plants, *Inhibition, *Design criteria, *Corrosion control, Chemical properties, Chemical reactions, Chlorides, Damages, Structural design, Evaluation, Laboratory tests, Desalination apparatus.
Identifiers: Desalination equipment materials.

Laboratory corrosion tests were conducted on 8 alloys in both aerated and deaerated brackish water. The alloys were all commercially available alloys normally used as materials of construction in desalination plants and were tested in the welded and non-welded condition. Flow velocities of 6 to 8 ft/sec were generally used, although some tests were conducted with the flow velocity being 12 to 16 ft/sec. The maximum test temperature was 125

deg C. Corrosion rates were determined from weight loss data after a minimum exposure period of 350 hours. Anodic polarization curves were determined for the alloys under static and velocity conditions and over a range of temperatures from 25 deg C to 75 deg C in brackish water using potentiostatic techniques. The effects of velocity of flow and/or temperature on the passivity of the alloys were determined. Correlations between the various alloys and between the potentiostatic data and velocity corrosion data were made where possible. The titanium alloy (2.5Sn-5.0A1) demonstrated the best corrosion resistance and could be passivated anodically under both static and velocity conditions for temperatures below 45 deg C. (Knapp-USGS)
W71-00064

SEEDING OF BRACKISH WATER IN A SPRAY FILM EVAPORATOR,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
John E. Jones, Jr.
Available from NTIS as AD-706 225, $3.00 in paper copy, $0.95 in microfiche. Report 1972, January 1970. 35 p.
Identifiers: *Desalination, *Corrosion inhibitation, *Sulfates, *Corrosion, Chemical precipitation, Evaporators, Calcium compounds, Sprays, *Brackish water, *Scale (Corrosion), Calcium sulfate.

When operating on many brackish waters, sea water distillation equipment becomes inoperative in a short time because of heavy deposits of calcium sulfate scale. Investigations are being made to evaluate a calcium sulfate crystal-seeding method for prevention of this scale formation in evaporators. The report covers tests performed at the Office of Saline Water, Roswell Test Facility to investigate the use of crystal-seeding techniques to inhibit the formation of sulfate scale in a horizontal-tube, spray-film evaporator. These crystal-seeding techniques were evaluated on a raw well water and well water with silica removed. A control test without crystal seeding was also conducted. The results of these tests indicate that on all waters tested, the crystal-seeding process can inhibit the formation of evaporator scale in a horizontal-tube, spray-film evaporator.
W71-00463

TREATMENT OF ACID MINE DRAINAGE OF REVERSE OSMOSIS.
Rex Chainbelt, Inc., Milwaukee, Wis.
For primary bibliographic entry see Field 05A.
W71-00477

RESEARCH ON IMPROVED REVERSE OSMOSIS MEMBRANES,
Gulf General Atomic, Inc., San Diego, Calif.
H. K. Lonsdale, R. L. Riley, C. E. Milstead, L. D. La Grange, and A. S. Douglas.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.25. Office of Saline Water Research and Development Progress Report No. 577, October 1970. 143 p, 46 tab, 28 fig, 62 ref. OSW Contract 14-01-0001-1778.

Descriptors: *Permselective membranes, *Membranes, *Osmosis reverse, *Desalination, Ion transport semipermeable membranes, Demineralization brackish water, Sea water, Demineralization, Diffusion, Osmosis.
Identifiers: *Composite membranes, Ultrathin films.

The principal objective was the development of a new concept in the preparation of reverse osmosis membranes. These membranes consisted of a very thin desalinating film suitably supported by a finely porous substrate. Much of the development was based on thin films of cellulose acetate with a high degree of substitution and a porous substrate consisting of mixed cellulose nitrate and cellulose acetate. The development has proceeded to the point where seawater desalinating membranes can be prepared and it is believed that the technique can be readily scaled up. At 1500 psi and with 3.5% NaCl brine, water fluxes of 10 gal./ft sq-day and salt rejections of 99.5% were achieved. Several other approaches in preparing new desalinating membranes were studied. These included interpolymer membranes from polyvinylpyrrolidone and several polyisocynates; polyelectrolyte membranes prepared by dip coating or casting a film of polyacrylic acid on a finely porous support membrane; and a micromosaic membrane for desalination by piezodialysis. The most promising was the polyacrylic acid membrance which could be useful for brackish water desalination. The properties of cellulose acetate membranes were explored in greater detail. The rejection of a number of inorganic and organic compounds and several salt mixtures were examined using the cellulose acetate membranes. (Kindley-Office of Saline Water)
W71-00481

MULTIPLE PHASE EJECTOR PILOT PLANT,
Kaye (Joseph) and Co., Inc., Cambridge, Mass.
John Leigh.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $2.25. Office of Saline Water Research and Development Progress Report 578. June 1970. 64 p, 30 fig, 8 ref. OSW Contract 14-01-0001-2105.

Descriptors: Desalination, *Distillation, *Evaporators, Jets, *Pilot plants.
Identifiers: *Multiple phase ejector, Steam-jet ejector, *Steam generator, Water-jet ejector, Vertical tube evaporator.

A pilot plant was designed, constructed, tested and turned over to an operating contractor at the Office of Saline Water, Wrightsville Beach Test Facility, Wrightsville Beach, North Carolina. The pilot plant utilizes a Multiple Phase Ejector having an availability efficiency of 30 percent with driving-stream inlet state at 500 deg F and 10 percent vapor quality, a horizontal spray film evaporator, and an oil-fired steam generator. This plant produces approximately 5000 pounds per hour of distillate and provides 2000 pounds per hour of dry saturated steam at 265 deg F to run a neighboring five-effect VTE pilot plant. The VTE pilot plant is capable of producing approximately an additional 10,000 pounds per hour of distillate. The combined plant demonstrates the ability of the MPE plant to reduce the net heat requirement per pound of distillate produced in the VTE plant, alone, from about 200 BTU to approximately 150 BTU in the combined plant. (Robinson-Office of Saline Water)
W71-00482

3B. Water Yield Improvement

NEW DEVELOPMENTS IN ATMOSPHERIC WATER RESOURCES,
Bureau of Reclamation, Denver, Colo. Office of Atmospheric Water Resources.
Archie M. Kahan, and Richard L. Eddy.
In: Advances in Hydroscience, Vol 6, New York, N.Y., Academic Press, p 1-41, 1970. 41 p, 8 fig, 1 tab, 37 ref.

Descriptors: *Cloud seeding, *Water yield improvement, *Reviews, Weather modification, Clouds, Nucleation, Statistical methods, Chemistry of precipitation, Meteorology, Rain, Water supply, On-site tests, Water management (Applied), Water resources development.
Identifiers: Atmospheric water management.

Cloud seeding for precipitation management is reviewed with emphasis on recent work in the United States. The present status in the field can be described as extremely encouraging when attention is given to single cloud experiments or limited area seeding in winter storms. A number of cloud-seeding techniques have been developed. Ground-based seeding, using silver iodide generators, is the most commonly used technique, especially for winter storms in mountainous terrain. Airborne seeding, using silver iodide or crushed dry ice, is frequently employed with summer convective storms. Careful attention must be given to matching the techniques (or tools) needed to form a balanced system to accomplish the job. A true precipitation management system should have: (1) a component to analyze the present and expected water needs and water sources, plus the anticipated effects of precipitation management; (2) a component to recognize weather in which precipitation management would result in the desired effect (or undesirable effects); (3) a component to select the proper treatment material and delivery system; and (4) a component to assess the results. The projects briefly reviewed include statistically designed studies in the United States and abroad, and long-term commercial projects. (Knapp-USGS)
W71-00006

GEOBOTANIC APPROACH FOR IMPROVEMENT OF RANGE RESOURCES IN DESERT AND SEMI-DESERT AREAS OF KAZAKHSTAN, USSR,
Central Arid Zone Research Inst., Jodhpur (India).
A. K. Chakravarty.
Paper based on lectures given by Soviet Specialists in a seminar at Alma-Ata, Kazakhstan, USSR, April-May, 1966. Author sponsored by FAO. Annals of Arid Zone, Vol 8, No 2, p 251-256, September 1969. 1 fig, 1 tab, 5 ref.

Descriptors: *Mapping, *Arid lands, *Pasture management, *Water distribution (Applied), *Productivity, Semiarid climates, Animals, Vegetation, Grasses, Water conservation, Deserts, Dry seasons, Moisture deficity, Range management, Seasonal.
Identifiers: *USSR, *Kazakhstan Republic, *Animal husbandry.

The Kazakh Republic possesses vast natural pasture lands, most of which are in desert and semi-desert zones. Almost all agriculture involves animal husbandry based on the fodder production of the natural pastures. However, annual climatic fluctuations lead to seasonal water deficits, thereby limiting productivity. Therefore, extensive studies were undertaken to devise increased production methods. Vegetational maps were constructed and surveys undertaken of soils, relief, vegetational associations, grass productivity, haymowing, land usage, range conditions, irrigation and cultivation. Plant nutritive values were determined and animal management practices were reviewed. The ultimate goals--at least in part accomplished--were to establish an ecological balance between animals and long term pasture usage on the basis of higher quality pastures and better seasonal water catchment methods. Surface and groundwater utilization are described. Exploitation of groundwater for increasing dry season production is important. (Casey-Arizona)
W71-00146

AGRICULTURAL EVOLUTION IN ISRAEL IN THE TWO DECADES SINCE INDEPENDENCE,
Oklahoma Univ., Norman. Dept. of Geography; Southwestern State Coll., Weatherford, Okla. Dept. of Geography; and West Florida Univ., Pensacola. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-00148

INTERPRETATION OF HYDROGEOLOGIC DATA FOR GROUNDWATER MANAGEMENT,
Geological Survey, Denver, Colo., and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00150

ROLE OF INFILTRATION GALLERIES IN AUGMENTING SUPPLIES TO THE PUMPING WELLS IN THE DESERTS,
H. S. Nagabhushanaiah.
Annals of Arid Zone, Vol 8, No 2, p 287-290, September 1969. 5 fig.

Descriptors: *Arid lands, *Shallow wells, *Hydrogeology, *Filters, *Groundwater basins, Artesian wells, Aquifers, Pervious soils, Infiltration, Permeability, Deserts, Wells.
Identifiers: *Infiltration galleries.

When large amounts of water for irrigation are drawn from shallow wells, overdraft may be avoided by the use of infiltration galleries, which are horizontal wells surrounded by graded filters. Groundwater is collected along their lengths and carried to the pumping well. Infiltration galleries are widely used around the world, but are restricted to shallow wells because of filter maintenance and location problems at greater depths. They are, therefore, rarely used in arid regions where groundwater levels are deep. There are, however, 2 exceptional hydrogeological situations where the use of infiltration galleries are feasible in the desert: (1) isolated shallow groundwater basins resulting in an artesian supply from a confined aquifer to an overlying unconfined aquifer and (2) shallow water tables due to backwater storage when an impermeable soil intercepts permeable soils. Factors in the design of appropriate infiltration galleries are discussed. Seepage flow for a given set of boundary conditions may be determined by the flow net method. (Casey-Arizona)
W71-00152

WATER-REPELLENT SOILS AND ANNUAL PLANT COVER IN A DESERT SCRUB COMMUNITY OF SOUTHEASTERN CALIFORNIA,
California Univ., Riverside. Dept. of Life Sciences.
For primary bibliographic entry see Field 02G.
W71-00158

STUDY OF WATER RESOURCES IN THE CHAD BASIN.
United Nations Educational, Scientific and Cultural Organization, Paris (France).
For primary bibliographic entry see Field 06D.
W71-00161

ON THE POSSIBILITY OF WEATHER MODIFICATION BY AIRCRAFT CONTRAILS,
Alaska Univ., College. Geophysical Inst.
For primary bibliographic entry see Field 02B.
W71-00369

INVENTORY AND ANALYSIS OF EXISTING WATER SUPPLY SYSTEMS AND POTENTIAL SOURCES OF SUPPLY, VOLUME IV.
Valley Regional Planning Agency, Ansonia, Conn.
For primary bibliographic entry see Field 04A.
W71-00434

LEGAL ASPECTS OF WATER STORAGE FOR FLOW AUGMENTATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 05G.
W71-00480

3D. Conservation in Domestic and Municipal Use

CITY OF CORAL GABLES V CRANDON (ESTABLISHMENT OF WATER CONSERVATION DISTRICT).
For primary bibliographic entry see Field 06E.
W71-00062

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'N (ADMINISTRATIVE ORDER TO SUPPLY WATER).
For primary bibliographic entry see Field 06E.
W71-00091

WHITE V WELSH (AUGMENTATION OF UTILITY CAPACITY).
For primary bibliographic entry see Field 06E.
W71-00093

KUEHN V VILLAGE OF MAHTOMEDI (CONFLICT BETWEEN PUBLIC AND PRIVATE OPERATORS OF WATER SYSTEMS).
For primary bibliographic entry see Field 06E.
W71-00094

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'M (PUBLIC UTILITIES REGULATION).
For primary bibliographic entry see Field 06E.
W71-00098

WATER FOR HOUSTON,
Turner, Collie and Braden Co., Inc., Houston, Tex.
For primary bibliographic entry see Field 06D.
W71-00315

A MUNICIPAL WATER DEMAND MODEL FOR THE CONTERMINOUS UNITED STATES,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 06A.
W71-00324

3E. Conservation in Industry

WATER FOR HOUSTON,
Turner, Collie and Braden Co., Inc., Houston, Tex.
For primary bibliographic entry see Field 06D.
W71-00315

ESTIMATED WATER USE IN FLORIDA, 1965,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 06D.
W71-00376

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM SALLISAW, OKLAHOMA.
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 313, $3.00 in paper copy, $0.95 in microfiche. Garver and Garver, Little Rock, May 1970. 64 p.
Identifiers: *Urban planning, *Oklahoma, *Inland waterways, *Harbors, Site selection, Economics, Commerce, Industrial plants, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning, Development, *Arkansas River, *Sallisaw (Oklahoma), *Sequoyah County (Oklahoma).

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the area; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development, including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-00456

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, DESHA COUNTY, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 312, $3.00 in paper copy, $0.95 in microfiche. Garver and Garver, Little Rock, May 1970. 64 p.
Identifiers: *Urban planning, *Arkansas, *Inland waterways, *Harbors, Site selection, Economics, Commerce, Industrial plants, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning, Development, *Arkansas River, *Desha County (Arkansas).

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the area; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-00457

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, VAN BUREN, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.

Available from NTIS as PB-191 311, $3.00 in paper copy, $0.95 in microfiche. Garver and Garver, Little Rock, May 1970. 72 p.

Descriptors:
Identifiers: *Urban planning, *Arkansas, *Inland waterways, *Harbors, Site selection, Economics, Commerce, Industrial plants, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning, Development, *Arkansas River, *Van Buren (Arkansas), *Sebastian County (Arkansas), *Crawford County (Arkansas).

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the area; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development, including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-00458

3F. Conservation in Agriculture

WATERSHED RESEARCH IN WESTERN NORTH CAROLINA - A STUDY OF THE EFFECTS OF AGRICULTURAL COVERS UPON THE HYDROLOGY OF SMALL WATERSHEDS.
Tennessee Valley Authority, Knoxville, and North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 04A.
W71-00033

AGRICULTURAL EVOLUTION IN ISRAEL IN THE TWO DECADES SINCE INDEPENDENCE,
Oklahoma Univ., Norman. Dept. of Geography; Southwestern State Coll., Weatherford, Okla. Dept. of Geography; and West Florida Univ., Pensacola. Dept. of Geography.
Arthur H. Doerr, Jerome F. Coling, and William S. Kerr, III.
Middle East Journal, Vol 24, No 3, p 319-337, Summer 1970. 3 fig, 49 ref.

Descriptors: *Water conservation, *Water transfer, *Crop production, *Rainfall, *Agriculture, Soil properties, Climatology, Topography, Economic efficiency, Arid lands, Semiarid climates, Planning, Irrigation, Moisture deficit, Specialty crops, Marketing, Sewage effluents, Saline water, Drainage systems.
Identifiers: *Israel, *Mediterranean agriculture.

Israel is a small, overpopulated country with marginal agricultural resources which has applied enormous scientific and technological methods in developing a crop agriculture. The emphasis on increased productivity has taken place within basically Mediterranean agricultural patterns--hardy perennials, winter grown annuals and irrigated specialties. A review of the physical environment reveals climatic patterns which cause an overall national water deficit and generally marginal edaphic and topographic conditions. The northern areas have a relatively favorable water economy, and irrigation and drainage projects within those locales are described. A national plan of water transfer from favored to more arid regions is in operation and is controlled by the Federal Government. When completed, a 120 mile interregional complex of water diversion structures will exist. Water is considered a state property and its use is carefully regulated. Additionally, major water conservation schemes are under development. Two of the most important concern saline water irrigation systems and utilization of sewage effluents. Efficient modern Israeli marketing schemes in western Europe for specialty crops are described. (Casey-Arizona)
W71-00148

LINEAR PROGRAMMING MODEL FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 06D.
W71-00165

RANGE AND WILDLIFE HABITAT EVALUATION--A RESEARCH SYMPOSIUM,
For primary bibliographic entry see Field 06G.
W71-00209

RESPONSE OF AGRICULTURAL CROPS TO FLOODING, DEPTH-OF-WATER TABLE AND SOIL GASEOUS COMPOSITION,
North Carolina State Univ., Raleigh. Dept. of Soil Science.
R. E. Williamson, and George J. Kritz.
American Society Agricultural Engineers Transactions, Vol 13, No 2, p 216-220, March-April 1970. 5 p, 1 fig, 3 tab, 49 ref.

Descriptors: *Crops, *Agriculture, *Saturated soils, *Soil gases, Water table, Plants, Root develolpment, Aeration.

Agricultural crops vary genetically and physiologically and thus require different soil water regimes for optimum production. To specify an optimum water-table depth, it is necessary to know at least the crop species, soil characteristics and watering procedure. Generally, grasses tolerate high water tables very well during cool seasons when the plants are dormant. Some crops such as strawberries are adversely affected by large fluctuations in the yearly water table (high in winter, low in summer). When a water table rises above some of the root system during a growing season and remains at a higher than normal level for more than one or two days, severe root pruning results. Experiments relating root function and plant performance to duration and extent of root system inundation should provide useful information for drainage design. Laboratory work has shown the root and shoot response of several plant species to various root zone gaseous compositions under varying conditions of temperature and radiant energy. Both in field and laboratory studies, relative to the problem of excess water and crop production, the air and water regime in relation to root function and total plant performance throughout its production cycle is the basic consideration. To restrict attention to the problem of excess water removal from a land area or to the specification of optimum water-table depths tends to abscure the real dimensions of the problem. Tables and curves relating data of the study are included. (Woodard-USGS)
W71-00217

EFFECT OF WATER-TABLE LEVELS ON EVAPOTRANSPIRATION AND CROP YIELD,
Agricultural Research Service, Raleigh, N.C. Soil and Water Div.
For primary bibliographic entry see Field 02D.
W71-00219

ENGINEERING AND ECONOMIC RELATIONS IN THE SELECTION AND CLASSIFICATION OF IRRIGABLE LANDS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 06B.
W71-00262

DRAINAGE PROBLEMS AND THE PROPOSED SOLUTION FOR A LARGE IRRIGATED AREA IN THE SAN JOAQUIN VALLEY OF CALIFORNIA (USA),
Westlands Water District, Fresno, Calif.
William R. Johnston.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.247-26.262, Mexico City, 1969. 16 p, 4 fig, 2 tab, 8 ref.

Descriptors: Irrigation, *Drainage, *Drainage costs, *Irrigated land, Drainage districts, Drainage engineering, Agriculture, Drainage systems, Perched water table, Saline water, Saline soils, *Waterlogged land, Costs, Design, Farms, Effluents, Groundwater.
Identifiers: San Joaquin Valley (Calif), San Luis Drain (Calif), *Irrigated agriculture, *Westlands Wtr Dist (Calif).

Under an irrigated agriculture regime, drainage problems develop slowly over many years before high groundwater or excess salinity affects the economy of an area. This is particularly true in an area where the irrigation program is accomplished with a limited water supply on slowly permeable soils and where drainage is impossible because of the absence of a suitable outlet. The 240,000-ha Westlands Water District, located in the semiarid San Joaquin Valley of California, is unique in that even prior to the time an annual delivery of 1,200,000 acre-ft of imported water was applied to the land, it was one of the most intensively cultivated irrigated agricultural areas in the world. The area has been irrigated for 25 to 30 yr, using a limited underground water supply pumped from depths of 120 to 240 m. Only a minimal water supply has been used in the area, but a perched water table has developed over approximately one-sixth of the District land, causing severe drainage problems and high salinity conditions in the crop root zone. The problem of agricultural drainage in this area is complex, but is being solved through local, state, and Federal cooperation. (USBR)
W71-00267

THE RELATIONSHIP AMONG THE FEDERAL GOVERNMENT DISTRICT BOARDS, MANAGERS AND WATER USERS ON NEW IRRIGATION AND DRAINAGE PROJECTS,
Bureau of Reclamation, Denver, Colo.
James M. Ingles.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.207-26.220, Mexico City, 1969. 14 p, 7 ref.

Descriptors: Irrigation, *Irrigation districts, *Water users, Costs, Federal Government, Irrigation operation and maintenance, Administration, Management, *Drainage districts, Decision making, State governments, Organizations, Training, Personnel, Associations, Planning.
Identifiers: Operating criteria.

An understanding of the functional relationship among project beneficiaries (water users) and various state and national organizations having direct or indirect responsibilities contributes significantly to the ultimate success of irrigation and drainage projects. The primary functional relationships that have evolved in the past century in the U S in organizing and managing new irrigation projects are discussed. The state is the subnational level of government that usually establishes legislative authority for water users' organizations and regulatory powers related thereto, especially in use of water. The National Government is the highest political institution of a country, and usually establishes policies and participates in land and water resource programs in the national interest. Water users' organizations consist of 3 groups: (1) the board of directors--the elected governing body; (2) the operating staff--usually a hired manager and employees; and (3) the individual water users--landowners and operators. Transition from operation of a project by the National Government to the ultimate objectives of self-operation by water users' organizations and the obligations and responsibilities involved are discussed. (USBR)
W71-00268

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

UNSTEADY SEEPAGE TOWARD NARROW DITCH,
Washington Univ., Seattle. Dept. of Civil Engineering.
Bruce W. Hunt.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7586, p 1953-1963, October 1970. 11 p, 5 fig, 1 tab, 4 ref, append.

Descriptors: *Ditches, *Seepage, *Unsteady flow, *Groundwater movement, Water levels, Aquifers, Water table, Drainage, Recharge, Drains, Surface-groundwater relationships.
Identifiers: Unsteady seepage.

A linearized solution is obtained for the unsteady, free surface seepage toward a ditch in an infinitely deep aquifer. The complex potential is defined to be the solution of a first order, linear, partial differential equation, and examination of the general solution for this equation reveals that a seepage surface cannot be imposed along the ditch boundary in the linearized model. A numerical example is treated, and it is pointed out that the same results can be used to describe the unsteady recharge of an aquifer under similar boundary conditions. (Knapp-USGS)
W71-00021

FREQUENCY OF DESIGN DROUGHT,
Colorado State Univ., Fort Collins. Natural Resources Center.
E. S. Joseph.
Water Resources Research, Vol 6, No 4, p 1199-1201, August 1970. 3 p, 1 fig, 2 tab, 3 ref.

Descriptors: *Droughts, *Planning, *Frequency analysis, *Design, *Water supply, Reliability, Reservoir design, Reservoir operation, Runoff forecasting, Water yield.
Identifiers: Design drought.

Certain problems associated with a drought frequency analysis were studied and their solutions are proposed. The techniques are based on a probabilistic framework. Return period of a project's design drought (the annual drought for which a water resource project such as a treatment plant or a low flow augmentation system has to be designed) is treated as a function of the project's useful life and the desired level of assurance. Assurance is the probability of nonoccurrence of droughts equal to or smaller than the design drought during the project's useful life. A method is given for estimating the probability and return period associated with the design drought of a project. A chart gives recurrence intervals of design droughts for various combinations of the estimated useful life of a project and the desired level of assurance. (Knapp-USGS)
W71-00025

FLOOD PLAIN INFORMATION, MINNESOTA RIVER, GRANITE FALLS, MINNESOTA.
Corps of Engineers, St Paul, Minn.

U S Army Corp of Engineers Flood Plain Report, June 1970. 44 p, 13 fig, 16 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Minnesota, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Granite Falls (Minnesota), Standard project flood, Intermediate regional flood.

Flooding along the Minnesota River and its overflow channels within the City limits of Granite Falls, Minnesota is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00026

WATERSHED RESEARCH IN WESTERN NORTH CAROLINA - A STUDY OF THE EFFECTS OF AGRICULTURAL COVERS UPON THE HYDROLOGY OF SMALL WATERSHEDS.
Tennessee Valley Authority, Knoxville, and North Carolina State Univ., Raleigh.

Tennessee Valley Authority and North Carolina State Univ Cooperative Report - Project Authorization No 445.1 Final Report published by Tennessee Valley Authority, June 1970. 115 p, 29 fig, 5 plate, 14 tab, 3 append.

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *North Carolina, Hydrology, Evapotranspiration, Soil conservation, Water conservation, Tennessee Valley Authority project, Overland flow, Runoff, Lysimeters, Gaging stations.
Identifiers: Experimental watersheds.

The hydrology of 6 small watersheds in Western North Carolina was studied from 1949 to 1970 to obtain information on the effects of agricultural covers on runoff. As watershed size diminishes, the effects of differences in soils become more pronounced and hydrometeorological variations over relatively small distances may become significant. Significant differences were found in the stormflow response attributable to the agricultural covers. On areas with deep permeable topsoils, the hydrologic differences among well-managed covers were minor, whereas with relatively impermeable topsoils, the cover and its management were found to have a much larger impact upon stormflow response. Runoff is contributed in an inverse relation to the capacity to (1) infiltrate and store rainfall and (2) store or transmit interflow. In farm planning, cover management should be related to the depth of the A horizon. In areas of thin or impermeable A horizon, and downslope from these areas, the best conservation covers, such as pasture, should be grown. In urban planning, provisions should be made for preserving sites with deep permeable soils as moisture storage zones. Typically, the alluvium along stream bottoms meets these criteria, and these areas should be preserved as 'green belts.' Paving or roofing of areas with fairly impermeable topsoils will not significantly change streamflow characteristics. (Knapp-USGS)
W71-00033

BRESHERS V NINETEENTH LA LEVEE DIST (DAMAGES RECOVERABLE FOR INJURY CAUSED BY LEVEE CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-00053

FLOOD PLAIN INFORMATION, BEARGRASS AND UPPER MILL CREEKS, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

Corps of Engineers Flood Plain Report, August 1969. 61 p, 25 fig, 15 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Kentucky, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Jefferson County (Ky), Louisville (Ky), Standard project flood, Intermediate regional flood.

Flooding of Beargrass and Upper Mill Creeks, Jefferson County, Kentucky is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00054

FLOOD PLAIN INFORMATION, MISSISSIPPI RIVER AND CAPE LA CROIX CREEK, CAPE GIRARDEAU, MO.
Corps of Engineers, St. Louis, Mo.

Corps of Engineers Flood Plain Report, December 1969. 60 p, 14 fig, 16 plate, 16 tab.

Descriptors: *Floods, *Flood damage, *Mississippi River, *Missouri, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Cape Girardeau (Mo), Standard project flood, Intermediate regional flood.

Flooding of the Mississippi River and Cape La Croix Creek, Cape Girardeau, Missouri is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00055

FLOOD PLAIN INFORMATION, OHIO RIVER, KENTON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

US Army Corps of Engineers Flood Report, December 1968. 34 p, 8 fig, 9 plate, 7 tab.

Descriptors: Floods, *Flood damage, *Ohio River, *Kentucky, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Kenton County (Kentucky), Standard project flood, Intermediate regional flood.

Flooding along the Ohio River in Kenton County, Kentucky is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating to extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00065

FLOOD PLAIN INFORMATION, OHIO RIVER, CAMPBELL COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

US Army Corps of Engineers Flood Plain Report, December 1968. 34 p, 8 fig, 13 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Ohio River, *Kentucky, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Campbell County (Kentucky), *Flood records, Standard project flood, Intermediate regional flood.

Flooding along the Ohio River in Campbell County, Kentucky is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00066

FLOOD PLAIN INFORMATION, FLORENCE, SOUTH CAROLINA.
Corps of Engineers, Charleston, S.C.

US Army Corps of Engineers Flood Plain Report, October 1967. 40 p, 8 fig, 15 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *South Carolina, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, Standard project flood, Intermediate regional flood.

Flooding along Jefferies Creek, Beaverdam Creek, Rye Branch, Gum Branch, and Gulley Branch in the vicinity of Florence, South Carolina is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00067

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
K. Body, G. Erdos, and K. Szesztay.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 280-288, 1968. 9 p, 7 fig.

Descriptors: *Digital computers, *Streamflow forecasting, *Gaging stations, *Time, Equations.
Identifiers: *Danube River.

Digital computer systems of gauge-relations were determined in order to forecast discharges of the

Danube River at the Iron-Gate section using data from 17 stations for roundly 2000 days for 5 and 10 day periods. Regularities of the streamflow regime of the river were described by relations between the discharges of selected gauging stations. Comparison of indices characterizing the closeness of gauge-relations derived on the basis of changes of discharges corresponding to different time intervals were applied for the determinination of travel times even under conditions of backwater effect. Special forecast equations were established for each day on the basis of data most characteristic for the streamflow regime conditions of the given day. (See also W71-00071) (Kriss-Cornell)
W71-00078

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION - 'SSARR' PROGRAM TO THE LOWER MEKONG RIVER,
D. M. Rockwood.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 329-344, 1968. 16 p, 4 fig, 6 ref.

Descriptors: *Digital computers, *Hydrology, *Synthesis, *Streamflow, *Reservoir operation.
Identifiers: Mekong River.

The general concepts of the streamflow synthesis and reservoir regulation-'SSARR'-program, togehter with highlights of its application to the Mekong River Hydrologic and Reservoir Regulation analyses were presented. Digital computer utilization and a discussion of areas of application to hydrologic engineering were given. The original version of the 'SSARR' program was developed in 1957. The computer program described in this paper was a 'third generation' program for streamflow synthesis. It was designed as a hydrologic and reservoir regulation model with application to a much wider range of conditions than the previous version and it greatly expanded logic for simulating hydrologic processes, channel routing techniques and reservoir regulation methods. The program provided a framework for future studies of hydrologic analyses of the Mekong River. (See also W71-00071) (Kriss-Cornell)
W71-00080

MISSISSIPPI STATE HIGHWAY COMM'N V YELLOW CREEK DRAINAGE DIST (BRIDGE CONSTRUCTION ENJOINED AS BEING INTERFERENCE WITH MAINTENANCE OF DRAINAGE DISTRICT).
For primary bibliographic entry see Field 06E.
W71-00081

HENRITZY V HARRISON COUNTY (RIGHT OF WAY SECURED VIA CONDEMNATION FOR SEA WALL CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-00083

WARREN V GEORGIA POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY BACKWATER FROM DAM).
For primary bibliographic entry see Field 06E.
W71-00086

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
M. J. Burley, and J. A. Cole.
The Use of Analog and Digital Computers in Hydrology, Vol II, p 584-590, 1968. 7 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Optimization, *Digital computers, *Dynamic programming, *Reservoirs, *Desalination plants, Surface waters, Costs, Risks.
Identifiers: Linked water resources.

The subject of linked water resources was viewed from two main aspects: (1) the computational problem of operating two linked storages optimally, for any given hydrology, given capacities, and fixed economic parameters of operation; and (2) the conjunctive use of a desalination plant and a surface water impoundment, at a given deficit risk. Month by month control rules were formulated by digital computer. Example (1) used a dynamic programming approach based on inflow probabilities, and catered for 64 possible combinations of reservoir contents and proceding inflows. Example (2) used a search of 34 years of inflows to find a 'worst case' basis for deciding at what reservoir contents the desalination plant should start to operate. By adopting the control rule it was shown that the linked system reduced operating costs by 30 to 50% below those of a year round supply by desalination. (See also W71-00071) (Kriss-Cornell)
W71-00088

KELLOG V HOTTMAN (INTERFERENCE WITH FLOW OF FLOODWATERS).
For primary bibliographic entry see Field 06E.
W71-00089

DETROIT TRUST CO V DINGMAN (AUTHORITY OF DRAINAGE DISTRICTS TO ALLOW INCIDENTAL SEWAGE DISPOSAL THROUGH DRAINAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-00092

LAGE V POTTAWATTAMIE COUNTY (FLOOD DAMAGE RESULTING FROM PUBLIC ACTIVITY).
For primary bibliographic entry see Field 06E.
W71-00096

JOHNSON V STARR (NEGLIGENT DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-00126

FINSETH V SPERRY (MAINTENANCE OF DRAINAGE SYSTEMS).
For primary bibliographic entry see Field 06E.
W71-00147

SINK V CITY OF LEXINGTON (LIABILITY FOR DAMAGE CAUSED BY BACKWATER FROM MUNICIPAL DAM).
For primary bibliographic entry see Field 06E.
W71-00206

FLOOD PLAIN INFORMATION, SANTA YNEZ RIVER (LOMPOC TO PACIFIC OCEAN), SANTA BARBARA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps of Engineers Flood Plain Report, January 1970. 51 p, 37 fig, 25 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *California, *Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Santa Barbara County (Cal), Standard project flood, Intermediate regional flood.

Flooding of the Santa Ynez River, Santa Barbara County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00208

FLOOD PLAIN INFORMATION, WHITE OAK CREEK, ROCK CREEK AND TOWN BRANCH, SULPHUR SPRINGS, TEXAS.
Corps of Engineers, New Orleans, La.

Corps of Engineers Flood Plain Report, September 1969. 39 p, 6 fig, 37 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Sulphur Springs (Tex), Standard project flood, Intermediate regional flood.

Flooding in Sulphur Springs, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W71-00224

ON THE DESIGN AND CONSTRUCTION OF INFILTRATION GALLERIES,
For primary bibliographic entry see Field 08A.
W71-00258

DRAINAGE PROBLEMS AND THE PROPOSED SOLUTION FOR A LARGE IRRIGATED AREA IN THE SAN JOAQUIN VALLEY OF CALIFORNIA (USA),
Westlands Water District, Fresno, Calif.
For primary bibliographic entry see Field 03F.
W71-00267

EISENSTEIN V MAYOR, COUNSELOR AND ALDERMEN (CITY'S DRAINAGE SYSTEM MUST BE ADEQUATE TO ACCOMMODATE USUAL RAINFALL).
For primary bibliographic entry see Field 06E.
W71-00279

MULTIRESERVOIR OPERATION STUDIES,
Arizona Univ., Tuscon; and Network Analysis Corp., Port Washington, N.Y.
For primary bibliographic entry see Field 06A.
W71-00281

THE WATERSHED IN PRINCIPLE,
Syracuse Univ., N.Y.
Peter E. Black.
Water Resources Bulletin, Vol 6, No 2, p 153-162.

Descriptors: *Watersheds (Basins), *Watershed management, *Planning, On-site data collections, Water control, Evaluation, Decision making.
Identifiers: *Fundamental concepts, Electrical analogy.

Three fundamental concepts linking drainage basin characteristics, stream behavior, and management of watersheds are deduced from field data and observations. An electrical analogy of a watershed clarifies definitions and broadens understanding of this complex natural resource. The three basic principles deal with: (1) The interrelationships of watershed morphology, constitution, and appearance; (2) the nature of the control man can exert over runoff-influencing forces, and (3) the efficiency of watershed management efforts. Recognition of these principles can assist educators, managers, planners and researchers to more fully inform students and to more effectively guide and evaluate management decisions. (Marriott-Chicago)
W71-00319

LAND AND WATER RESOURCES MANAGEMENT FOR ENVIRONMENTAL IMPROVEMENT,
Department of Agriculture, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-00320

FLOOD PLAIN MODELING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Frank E. Perkins.
Water Resources Bulletin, Vol 6, No 3, p 375-385, May-June 1970. 5 fig, 7 ref.

Descriptors: *Computer models, *Mathematical models, *Rainfall-runoff relationship, River basins, Simulated rainfall, Water management (Applied), Flood control.

Computer simulation of river basin hydrology has progressed from an interesting academic exercise to a practical engineering procedure of increasing utility. Mathematical models of the many interrelated processes which occur in a basin have been developed along with efficient numerical procedures for their solution. This paper is concerned with a particular model which has been used to describe the transformation of a temporarily and spatially varying rainfall into a time history of stage and discharge on a flood plain. Although developed as a model of the physical processes involved, it is envisioned that the model can serve as one component of an information system for flood plain planning and management. The model consists of three elements: (1) a rainfall simulation which generates stochastic inputs to the model according to specified rainfall statistics, (2) a catchment-runoff model which converts the rainfall to surface runoff, (3) a flood stage model which converts the surface runoff to time histories of flood stage and discharge. The model has been used to investigate the effect of various structural for each of these. Of particular interest in development of the model have been recurring and partially unanswered questions relative to the proper balance among availability of data for use in the model, data requirements of the model and the objectives of the outputs produced by the model. (Marriott-Chicago)
W71-00321

JOINT PROBABILITY METHOD OF TIDE FREQUENCY ANALYSIS APPLIED TO ATLANTIC CITY AND LONG BEACH ISLAND, N. J.,
Weather Bureau, Silver Spring, Md.
Vance A. Myers.
Environmental Science Services Administration Technical Memorandum WBTM HYDRO 11, April 1970. 109 p, 41 fig, 20 tab, 20 ref.

Descriptors: *Tides, *Surges, *Hurricanes, *Statistical models, *Probability, Frequency analysis, Tidal energy, Flood forecasting, New Jersey, Storms, Waves (Water), Wave pile-up, Wind tides.
Identifiers: Joint probability, Tide frequency.

This paper describes the frequency analysis of combined storm surges and periodic tides prepared by ESSA as part of the Long Beach Island (New Jersey) study. These frequencies apply to the ocean beach. The Long Beach Island study is a pilot study in a new area. It is intended to serve as a guide to other studies of other coastal communities as well as to provide needed criteria at this one location. The frequency curve is extended beyond observed storm data by including hypothetical tides calculated from hypothetical storms chosen so as to represent future possibilities. Recent advances in the technique of computing surges from hurricane wind fields by solving simplified forms of the applicable dynamic equations make it possible to determine surges in a statistical manner for several hundred hypothetical hurricanes, representing different combinations of climatological hurricane characteristics. In calculating hypothetical tides, storm surges are combined with the astronomical tide in a random manner rather than being made coincident with astronomical high tide only. This joint probability approach is described in detail. (Knapp-USGS)
W71-00378

AN ANNUAL REPORT OF THE CHEMICAL CONTROL OF ALLIGATORWEED,
University of Sourthwestern Louisiana, Lafayette. Dept. of Chemical Engineering.
F. W. zur Burg, J. A. Foret, S. L. Solymosy, W. K. Averitt, and J. R. Barry.
Southwestern Louisiana University - Department of the Army, Corps of Engineers Cooperative Investigation, June 30, 1970. 231 p, 15 chart, 24 tab, 3 ref. Corps of Engineers Contract DACW-68-C-0006.

Descriptors: *Aquatic weed control, *Alligatorweed, *Herbicides, *Aquatic weeds, Weed control, Vegetation regrowth, Defoliants, Plant growth regulators.
Identifiers: (2,4-D).

When alligatorweed is treated with the chlorinated phenoxy type herbicides, the above-water portions of the plant are destroyed and regrowth takes place from one or more nodes beneath the water. Therefore, work was directed toward some method that would act on the secondary growth. Herbicides were applied to water in a pellet form to allow extremely slow release. Attempts were also made to disperse droplets of an oil soluble form of 2, 4-D into the water and then to add coagulating agents which would collect some droplets of 2, 4-D on the nodes and other underwater parts. No single commercial herbicide was found satisfactory. Phenoxy herbicides are most useful when applied to the roots of the plant. Application of 2, 4-D plus Silvex plus molasses gave the best results, a 90% kill below water. Some new chemicals, notably Ethrel, gave fair results. A virus disease which weakened plants should be studied as a possible control method. (Knapp-USGS)
W71-00396

FLOOD CONTROL AND DRAINAGE IN INDIA,
Central Water and Power Commission, New Delhi, (India).
P. N. Kumra.
Water Resources Journal, United Nations Economic Commission for Asia and the Far East (ST/ECAFE/SER. C/83), p 27-38, December 1969. 12 p.

Descriptors: *Floods, *Flood control, *Non-structural alternatives, Warning systems, Flood plain zoning, Reservoirs, Floodways, Channel improvement, Cost-benefit analysis.
Identifiers: *India.

Though floods in India are as old as the rivers themselves, the floods of the last decade and, more recently, of October 1968, have given rise to serious concern. With the development activities and increase in population in the country, there has been continued encroachment on the flood plains of the rivers with the result that the floods of the same intensity cause more damage now than before. The States affected by recurring floods are Andhra Pradesh, Assam, Bihar, Haryana, Jammu and Kashmir, Orissa, Punjab, Uttar Pradesh and West Bengal. The flood-protection methods in use can be broadly classified as (1) administrative and (2) engineering. Aministrative methods consist of flood forecasting and warning, and flood-plain zoning. One category of works aims at reducing the magnitude of the flood flows at the damage center, thereby reducing the spill and consequent damage. In the other category, the intensity of floods is not reduced but an attempt is made to reduce the damage by confining the flood flows and preventing spilling. Such works include embankments and channel improvements. (Knapp-USGS)
W71-00400

THE BENEFICIAL USE OF STORM WATER, FINAL REPORT, A SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT, AND REUSE OF STORM WATER.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 05D.
W71-00409

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWER OVERFLOWS - BUCYRUS, OHIO.
Burgess and Niple Ltd., Columbus, Ohio.
For primary bibliographic entry see Field 05D.
W71-00412

BURIED ASPHALT MEMBRANE CANAL LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Fred H. Geier, and William R. Morrison.
Available from NTIS as PB-193 143, $3.00 in paper copy, $0.95 in microfiche. Research Report No. 12, 1968, 58 p.
Identifiers: *Inland waterways, Bituminous coatings, *Asphalt, Bituminous coatings, *Bituminous coatings, Aging (Materials), Test methods, Moistureproofing, *Canal linings.

Analysis of test results and visual observations on membrane samples after 14 years' service did not reveal any serious deficiencies in the asphalt membrane lining. Of the 112 field samples evaluated from 20 different canal installations, more than 80 percent demonstrated satisfactory resistance to field aging. The membranes in poor condition resulted from accelerated aging primarily due to defective construction practice. Test results indicated that thickness is one of the more important factors contributing to life of the asphalt membrane. For a majority of the membranes evaluated, the change in physical properties due to field aging did not materially affect their ability to provide a flexible, watertight lining. Tests indicated that the greatest portion of this change occurs during the first 6 years of service. After this period, the rate of change is slower. An aging index was calculated through a computer program to determine the relative change in the physical properties of the membrane. This study reaffirms the point that adequate seepage control will be maintained for many years if the membrane is installed in accordance with current specifications.
W71-00433

INVENTORY AND ANALYSIS OF EXISTING WATER SUPPLY SYSTEMS AND POTENTIAL SOURCES OF SUPPLY, VOLUME IV.
Valley Regional Planning Agency, Ansonia, Conn.

Available from NTIS as PB-192 941, $3.00 in paper copy, $0.95 in microfiche. Malcom Pirmi Engineers, White Plains, N.Y., February 1970. 45p.
Identifiers: *Urban planning, *Connecticut, *Water supplies, Urban planning, Rivers, Water wells, Consumption, Industries, Statistical analysis, *Regional planning and development, *Sewers, Water resources, Watersheds.

The report is the fourth of a five-folume series prepared to serve as part of the basis for an area-wide water/sewer plan and program for the Valley Region. The present volume includes an inventory and evaluation of the major water supply systems and potential sources of supply existing or being developed to serve the Valley Region.
W71-00434

WATER AND SEWERAGE STUDY, SECOND PHASE.
Morris County Planning Board, Morristown, N.J.
For primary bibliographic entry see Field 05G.
W71-00435

A MASTER SEWERAGE PLAN FOR UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 05G.
W71-00436

INVESTIGATION OF SOIL-STRUCTURE INTERACTION: FLEXIBLE CULVERT PIPES,
Ohio State Univ., Columbus. Engineering Experiment Station.
For primary bibliographic entry see Field 08A.
W71-00441

RICHMOND REGIONAL SEWERAGE PLAN AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00445

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00446

SURFACE STORM WATER RUNOFF AND DRAINAGE STUDY FOR ESSEX COUNTY, NEW JERSEY.
Essex County Planning Board, Belleville, N.J.

Available from NTIS as PB-192 358, $3.00 in paper copy, $0.95 in microfiche. December 1969. 55 p.
Identifiers: *Management planning, New Jersey, *Economics, *Storms, Drainage, Design, Soils, Terrain, Surfaces, Geology, Construction, Structures, Statistical data, Tables, Urban areas, *Essex County (New Jersey), *Regional planning, Area planning, Development, *Storm sewers, *Surface water runoff, Watersheds.

The report analyzes storm frequency information and provides a study design prototype applicable county-wide for small watershed developments. Physical characteristics and surface imperviousness studies were made relating criteria of physical properties of soils, geology, topography (slope) and future land use to storm runoff expectations consistent with County and municipal comprehensive planning programs. Recommendations were made for future programs and measure required to better plan for future storm drainage facilities in Essex County.
W71-00448

WATER AND SEWER FACILITIES PLAN: VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.
For primary bibliographic entry see Field 05G.
W71-00450

STORM DRAINAGE IN THE TOLEDO REGIONAL AREA.
Toledo Regional Area Plan for Action, Ohio.

Available from NTIS as PB-191 387, $3.00 in paper copy, $0.95 in microfiche. Regional Report 9.3. Office of the Lucas County Engineer, September 1969. 118 p.
Identifiers: *Drainage, Urban planning, *Ohio, Drainage, Terrain, Inventory, Floods, Sanitary engineering, Standards, Problem solving, Budgets, Combined sewers, *Storm sewers, *Toledo (Ohio).

The report is an inventory and analysis of existing storm drainage systems. The collected information provides a basis for solving immediate drainage problems, guiding new development to those areas amenable to good drainage, and planning for future drainage improvements. Subject areas covered by the study include: planning and financing of storm drainage facilities; general standards for storm drainage systems; mapping of watershed areas; computation of storm water runoff and water surface elevations. Two important problem areas examined are flooding and combined sewers.
W71-00454

WATER AND SEWER PLAN FOR THE TUSCALOOSA METROPLITAN AREA.
Tuscaloosa Area Council of Local Governments, Ala.
For primary bibliographic entry see Field 05G.
W71-00459

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS, PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWERS BY HIGH-RATE, FINE-MESH SCREENS.
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
For primary bibliographic entry see Field 05D.
W71-00476

ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA,
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
For primary bibliographic entry see Field 05G.
W71-00478

PROPOSED COMBINED SEWER CONTROL BY ELECTRODE POTENTIAL.
Merrimack Coll., North Andover, Mass.
For primary bibliographic entry see Field 05G.
W71-00479

SIMULATION OF CONTINUOUS DISCHARGE AND STAGE HYDROGRAPHS IN THE NORTH BRANCH OF THE CHICAGO RIVER.
Hydrocomp International, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 02E.
W71-00483

MATTHEWS V UNITED STATES (LIABILITY FOR CONSEQUENTIAL FLOODING CAUSED BY FLOOD CONTROL PROJECT).
For primary bibliographic entry see Field 06E.
W71-00496

JOHNSON V UNITED STATES (FLOODING CAUSED BY INCREASING DAM HEIGHT).
For primary bibliographic entry see Field 06E.
W71-00499

MOBILE AND O RR V RED FEATHER COAL CO (LIABILITY FOR OBSTRUCTION TO FLOW OF INTERMITTENT STREAM).
For primary bibliographic entry see Field 06E.
W71-00529

GUILLORY V FONTENOT (PROPER USE OF FLOODGATES NOT AN OBSTRUCTION TO NATURAL DRAINAGE OF LAND).
For primary bibliographic entry see Field 06E.
W71-00534

BESLER V GREENWOOD (INJUNCTION TO PREVENT OBSTRUCTING NATURAL FLOW OF DRAINAGE WATER).

212 NW 120-121 (Iowa 1927).

Descriptors: *Iowa, *Obstruction to flow, *Damages, *Tile drains, Watercourses (Legal), Alteration of flow, Riparian rights, Riparian land, Riparian waters, Relative rights, Drains, Tiles, Ditches, Bank erosion, Outlets, Overflow, Drainage water, Judicial decisions, Legal aspects, Surface waters, Surface runoff, Natural flow.

Plaintiff and defendant owned adjacent lands. Plaintiff sought an injunction against defendant's placing of obstructions in a natural drainage ditch which drained plaintiff's and defendant's property. Plaintiff also sought damages caused by water which backed up on his property allegedly due to such obstructions. The court stated that plaintiff had a right to drain his land in the general course of the natural drainage by constructing a covered drain discharging the water at the point the water would naturally flow into a natural water course. Plaintiff was entitled to an injunction restraining defendant from obstructing the flow of water in the ditch. However, plaintiff's claim to damages was not sustained since no evidence appeared showing whether the backup was due to defendant's obstructions or to a sack found in plaintiff's tile drain, both of which would have been sufficient to effectuate the overflow. The trial court's judgment for defendant was affirmed in part and reversed in part. (Price-Florida)
W71-00550

4B. Groundwater Management

FLORIDA WATER AND RELATED LAND RESOURCES--ST. JOHNS RIVER BASIN.
Florida Dept. of Natural Resources, Tallahassee.
For primary bibliographic entry see Field 06B.
W71-00010

ELECTRIC ANALOG MODEL EVALUATION OF A WATER-SALVAGE PLAN, SAN LUIS VALLEY, SOUTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
Philip A. Emery.
Colorado Water Conservation Board Groundwater Series Circular No 14, 1970. 11 p, 4 fig, 3 plate, 1 tab, 7 ref.

Descriptors: *Analog models, *Water management (Applied), *Groundwater basins, *Evapotranspiration control, *Withdrawal, Groundwater, Water levels, Water level fluctuations.
Identifiers: San Luis Valley (Colo).

An electric analog model was constructed as part of a water-resources appraisal study of the San Luis Valley in south-central Colorado. The model is used to synthesize the hydrology of the valley and to predict the effects of changes in water management. The plan called for salvaging water being consumed by nonbeneficial vegetation in the central part of the valley by pumping a network of wells. This part of the valley is internally drained. The model was used to predict the effects of pumping annually about 84,000 acre-feet of water from 129 wells for a 50-year period. The predicted decline in groundwater levels ranged from 1 to 100 feet. The major part of the water pumped is groundwater that would have been lost to evapotranspiration (84%) and the remainder is from groundwater storage (14%) and the Rio Grande (2%). (Knapp-USGS)
W71-00034

RESULTS OF TEST DRILLING AT THE CENTRAL GREAT PLAINS FIELD STATION NEAR AKRON, NORTHEASTERN COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00037

GROUNDWATER RESOURCES OF THE LOWER HILLSBORO CANAL AREA, SOUTHEASTERN FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02F.
W71-00039

HYDROGEOLOGIC DATA FOR THE LOWER ARKANSAS RIVER VALLEY, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00047

A STUDY IN THE GROUNDWATER HYDROLOGY OF THE MEERUT DISTRICT, UTTAR PRADESH, INDIA,
Banaras Hindu Univ., Varanasi (India). Dept. of Geography.
For primary bibliographic entry see Field 02F.
W71-00057

WATER-LEVEL RECORDS FOR THE NORTHERN HIGH PLAINS OF COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00060

CALIFORNIA'S DIGITAL COMPUTER APPROACH TO GROUNDWATER BASIN MANAGEMENT STUDIES,
California Dept. of Water Resources; and TRW Systems Group, Redondo Beach, Calif.
E. M. Weber, H. J. Peters, and M. L. Frankel.
Use of Analog and Digital Computers in Hydrology, Vol I, p 215-223, 1968. 9 p, 4 fig.

Descriptors: *Computer programs, *Digital computers, *Groundwater basins, *Optimization, *cost, *Mathematical models, Management.

A computerized approach to the planning studies of integrated management of groundwater basin supplies, storage and transmission, conjunctively with surface water supplies, storage and transmission, developed since 1959, was described. A two spaced-dimensional diffusion mathematical model of the groundwater basin was developed which incorporated the nonlinear features of transmissibility variation with saturated thickness, rising and repercolating waters, and transmissibility variation (constrictions) at depth. Mathematical models of pipeline networks were developed to simulate the hydraulic characteristics of the expanding system and maximum delivery capacities were estimated. Selection of the digital approach was related to data availability, the sensitivity of the economic analysis to the scale of the physical model, and the application of digital computers in the economic analysis phase of the studies. Digital model validation was speeded by on-line hydrograph plots. A cost equation was developed to determine the most economical combination of pumping and surface storage facilities. The studies described and the models discussed have been used in studies of many geographical locations. (See also W71-00071) (Kriss-Cornell)
W71-00073

THE ARCHIVES FOR GROUNDWATER LEVELS T.N.O. IN THE NETHERLANDS,
Rijksinstituut voor Drinkwatervoorziening, Delft (Netherlands).
For primary bibliographic entry see Field 02F.
W71-00144

ROLE OF INFILTRATION GALLERIES IN AUGMENTING SUPPLIES TO THE PUMPING WELLS IN THE DESERTS,
For primary bibliographic entry see Field 03B.
W71-00152

ROCK MOVEMENT TRIGGERED BY A WATER-LEVEL CHANGE IN THE BRUNSWICK AREA, GEORGIA,
Geological Survey, Brunswick, Ga.
For primary bibliographic entry see Field 02F.
W71-00177

NONSTEADY INFLOW TO A CHAMBER WITHIN A THICK AQUITARD,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00179

DETERMINING TRANSMISSIVITY FROM WATER-LEVEL RECOVERY OF A STEP-DRAWDOWN TEST,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 02F.
W71-00180

OPTIMIZATION OF CONJUNCTIVE USE OF WATER IN A STREAM-AQUIFER SYSTEM, USING LINEAR PROGRAMMING,
Geological Survey, Denver, Colo.
O. James Taylor.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402--Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C218-C221, 1970. 4 p, 2 fig, 5 tab, 3 ref.

Descriptors: *Conjunctive use, *Surface waters, *Aquifers, *Surface-groundwater relationships, *Optimization, Computer programs, Linear programming, Water demand, Irrigation water, Water resources development, Water management (Applied), Colorado.
Identifiers: Arkansas River (Colo).

A linear program was used to show how conjunctive use of groundwater and surface water in a stream-aquifer system can be manipulated to minimize depletion of the stream. The program was designed to achieve the objective by satisfying the demand for irrigation water, using groundwater and surface water selectively during a 2-month period. If the irrigation system of a river basin can be reduced to a series of linear equations of tolerable errors, a great deal of insight is provided by the solution and sensitivity analysis of a linear program. The results of the program are highly dependent on the specified constraints which should be based on field measurements. (Knapp-USGS)
W71-00182

GEOLOGY AND GROUNDWATER RESOURCES OF PITT COUNTY, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02F.
W71-00188

USE OF ALLUVIAL FAULTS IN THE STORAGE AND RETENTION OF GROUNDWATER,
Department of Water and Power, Los Angeles, Calif.
Dennis E. Williams.
Groundwater, Vol 8, No 5, p 25-29, September-October 1970. 5 p, 5 fig, 5 ref.

Descriptors: *Artificial recharge, *Water management (Applied), *Groundwater movement, *Faults (Geology), Water storage, Alluvium, Aquifers, Water spreading.
Identifiers: Owens Valley (Calif).

Recent investigations of the faults in California's Owens Valley reveal that they are semipervious, or leaky in nature. The rate of groundwater movement through a semipervious alluvial fault is dependent upon the hydraulic conductivity of the fault gouge, the thickness of this zone, and the water-level differential across the fault. Optimization of the groundwater resources in the Owens Valley is currently practiced using these faults in a controlled recharge-extraction-salvage system. In a system of this type, artificial recharge is induced into the Valley's aquifers upgradient from alluvial fault zones. Salvage of groundwater is accomplished by lowering the water table in the vicinity of these faults. (Knapp-USGS)
W71-00196

DETERMINING THE SUSTAINED YIELDS OF WELLS IN CARBONATE AND FRACTURED AQUIFERS,
Pennsylvania State Univ., University Park. Mineral Conservation Section.
Richard R. Parizek, and Shamsul H. Siddiqui.
Groundwater, Vol 8, No 5, p 12-20, September-October 1970. 9 p, 7 fig, 2 tab, 11 ref.

Descriptors: *Water yield, *Aquifers, *Karst, Limestones, Fractures (Geology), Transmissivity, Drawdown, Groundwater movement, Hydrogeology, Theis equation, Water levels.
Identifiers: Well testing, Aquifer evaluation.

Carbonate aquifers with highly developed anisotropic permeabilities and other fractured rocks under water-table or semiwater-table conditions present complex hydrologic settings in which to predict the sustained yield of individual wells or groups of wells. Yields of wells in these settings are particularly responsive to the position of the water level and its relationship to one or more producing zones. Often total well capacity may be accounted for by a few openings separated by essentially nonproductive rock. A permeability profile must be defined for these wells. Permeability profiles may be roughly estimated from detailed driller's logs and caliper logs, and more precisely determined from flow meter surveys, packer tests and by pumping wells after successive increments of drilling or by a combination of increasing casing lengths and extended drilling. Test holes may be drilled immediately adjacent to the potential production well to define the inclination of individual conduits or wells test pumped when possible at rates sufficient to draw the pumping level to the top of the opening in question. (Knapp-USGS)
W71-00201

SMALL WELLS MANUAL--A MANUAL OF LOCATION, DESIGN, CONSTRUCTION, USE AND MAINTENANCE,
Minnesota Univ., Minneapolis. Div. of Environmental Health.
For primary bibliographic entry see Field 08A.
W71-00305

HYDRAULIC TESTING OF WELLS IN CENTRAL NEVADA,
Geological Survey, Denver, Colo.
George A. Dinwiddie.
Geological Survey Open-file Report USGS-474-80, June 1970. 110 p, 56 fig, 5 tab, 1 ref. Contract AT (29-2)-474 USAEC.

Descriptors: *Hydrogeology, *Aquifers, *Igneous rocks, *Nevada, Permeability, Groundwater movement, Porosity, Transmissivity, Velocity, Hydraulic conductivity, Storage coefficient, Water wells, Observation wells, Tracers, On-site tests.
Identifiers: Aquifer testing, Well testing, Pumping tests.

This report, prepared in support of the U. S. Atomic Energy Commission's underground nuclear testing program in central Nevada, presents basic data obtained during hydraulic tests in six exploratory holes before February 1968. The wells penetrated alluvium, welded tuff, bedded tuff, and rhyolite. (Knapp-USGS)
W71-00307

DYNAMIC PROGRAMMING FOR OPTIMUM CONJUNCTIVE USE,
Nevada Univ., Reno. Desert Research Inst.
Gilbert F. Cochran, and William S. Butcher.
Water Resources Bulletin, Vol 6, No 3, p 311-322, May-June 1970. 6 fig, 1 tab, 12 ref.

Descriptors: *Water management, *Dynamic programming, *Conjunctive use, *Water utilization, *Water distribution (Applied), Water costs, Economics, Legal aspects, Water Law.
Identifiers: Las Vegas (Nevada).

This study was designed to determine how best the Las Vegas Valley Water District might intergrate the use of the existing groundwater and anticipated imported surface water. The consequences of certain provisions in the Nevada Water Law were examined to determine their effects on the groundwater system and costs of water. A dynamic programming technique was utilized. The problem as formulated consists of a single decision variable, single state variable dynamic programming algorithm evaluated over a fifty-year planning horizon at monthly intervals. In all solutions operating rules regarding groundwater pumping distribution and use of surface-water system are kept constant. The problem is considered deterministic in all respects. Optimization of conjunctive use of the water district is based on the objective function of minimizing water production costs. Results of the study are presented as a series of policy traces under each of the three alternatives considered. These traces describe the groundwater basin response under optimal operating conditions, given an estimate as to the present worth of groundwater pumping rights, and prescribe monthly water-procurement schedules for the operation of the water district. It is concluded that by using dynamic programming techniques it is possible to examine some economic and physical effects of groundwater conservation measures on a relatively complex system over a long period of time; and provides an optimal operating guide to system utilization for a given set of physical, legal, and economic parameters. (Marriott-Chicago)
W71-00323

COMPUTATION OF RATE AND VOLUME OF STREAM DEPLETION BY WELLS,
Geological Survey, Washington, D.C.
C. T. Jenkins.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402--Price $0.30. Geological Survey Techniques of Water-Resources Investigations, Book 4, Chapter D1, 1970. 17 p, 5 fig, 3 tab, 13 ref.

Descriptors: *Surface-groundwater relationships, *Conjunctive use, Groundwater movement, Induced infiltration, Water management (Applied), Water table, Water wells, Water yield, Water levels, Equations, Streamflow.
Identifiers: Stream depletion by wells.

The depletion in flow of a nearby stream caused by pumping a well can be calculated by using dimensionless curves and tables. Computations can be made of (1) the rate of stream depletion at any time during the pumping period or the following nonpumping period (2) the volume of water induced from the stream duing any period, pumping or nonpumping, and (3) the effects, both in rate and volume of stream depletion, of any selected pattern of intermittent pumping. Sample computations illustrate the use of the curves and tables. An example shows that intermittent pumping may have a pattern of stream depletion not greatly different from a pattern for steady pumping of an equal volume. The residual effects of pumping, that is, effects after pumping stops, on streamflow may often be greater than the effects during the pumping period. Adequate advance planning that includes consideration of residual effects thus is essential to effective management of a stream-aquifer system. (Knapp-USGS)
W71-00354

GROUNDWATER IN GREENE COUNTY, NEW YORK,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 02F.
W71-00363

4C. Effects on Water of Man's Non-Water Activities

COMPILATION OF HYDROLOGIC DATA, AUSTIN, TEXAS, 1968.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 02E.
W71-00041

QUALITY AND SEASONAL FLUCTUATION OF HEADWATER STREAMS IN MONTANA,
Montana Forest and Conservation Experiment Station, Missoula.
For primary bibliographic entry see Field 05A.
W71-00142

EFFECTS OF URBANIZATION ON THE QUALITY OF SELECTED STREAMS IN SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05B.
W71-00175

INFLUENCE OF LAND USE ON RUNOFF FROM AGRICULTURAL WATERSHEDS,
Ohio State Univ., Columbus.
V. T. Ricca, P. W. Simmons, J. L. McGuinness, and Paul E. Taiganides.
American Society Agricultural Engineers Transactions, Vol 13, No 2, p 187-190, March-April 1970. 4 p, 3 fig, 5 tab, 6 ref. OWRR Project B-005-Ohio.

Descriptors: *Watershed management, *Land use, *Runoff, *Agriculture, Streamflow, Rainfall, Reforestation, Groundwater, Water table, Percolation, Hydrology, Hydrologic data.
Identifiers: North Appalachian Experimental Watershed (Ohio).

Thirty years of runoff data from agricultural watersheds at the North Appalachian Experimental Watershed were analyzed to determine the effects of land use on streamflow. Reforestation and improved cropping reduced annual and seasonal streamflow. High flows were reduced in both seasons, but the treatment effects on low flows were not consistent. A decrease in percolation potential was indicated by the declining trend of the November 1 groundwater level. The time trend of flow changed from strongly negative in the first 10 years to insignificant in the last 10 years of record, indication that the major effects of land use and treatment on streamflow have been reached. Hydrologically, the treated watersheds have stabilized in their new flow regimes. (Woodard-USGS)
W71-00218

SOME OBSERVATION OF STREAMFLOW AND WATER QUALITY IN THE URBAN ENVIRONMENT,
Geological Survey, Washington, D.C. Water Resources Div.
Andrew M. Spieker.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968) ed. Phillip Cohen, Martha N. Francisco, p 742-753. 10 fig, 3 ref.

Descriptors: *Streamflow, *Water quality, *Urbanization, Low-flow augmentation, Dissolved oxygen, Biochemical oxygen demand, Dissolved solids, Coliforms, Sewage effluents, Sludge disposal, Storm runoff, Groundwater.
Identifiers: *Salt Creek basin, Water quality parameters, Metropolitan Sanitary District of Greater Chicago, Combined sewage systems.

The effects of urbanization on the hydrologic regimen are studied through observation of the Salt Creek basin in Illinois from 1940 to 1965. Although most studies of urban hydrology have been concerned with the effects of urbanization on low flows may be significant. Flow-duration curves from two gaging sites show differences between four subsidiary periods between 1951 and 1965. Changes in sewage disposal practices, such as affiliation with Metropolitan Sanitary District of Greater Chicago, may reduce flow almost completely during day periods. On the other hand, where a community operates its own treatment plant, increased population bring about increased sewage effluent discharge. Variations in water quality with streamflow are indicated using four parameters: dissolved oxygen (DO), biochemical oxygen demand (BOD), coliform bacteria, and total dissolved solids. Other parameters which have been ignored but which are necessary to give a complete picture of water quality are listed. Nevertheless, DO and BOD readings at several locations during flooding conditions and low flow conditions show favorable DO readings during the flooding period. Exceptions are explained as resulting from untreated discharge from combined sewer systems. Regarding dissolved solids, concentration is much higher at low flow. Coliform bacterial counts were higher during high flows with combined sewers, accumulated sludge in the streambed, and storm runoff as important contributors. Discussion is given to augmenting low flows and to clearing and cleaning accumulated sludge deposits from stream bottoms. (Preckwinkle-Chicago)
W71-00318

SEDIMENT PROBLEMS IN URBAN AREAS,
Geological Survey, Washington, D.C.
Harold P. Guy.
Available free on application to the U.S. Geological Survey, Washington, D.C. 20242. Geological Survey Circular 601-E, 1970. 8 p, 6 fig, 1 tab, 22 ref.

Descriptors: *Urbanization, *Sedimentation, *Soil erosion, *Stream erosion, Sediment load, Sediment transport, Damages, Water law, Floods, Flood damages, Cities, Water pollution sources.
Identifiers: Urban sediment sources.

Soil erosion and sediment deposition in urban areas are as much an environmental blight as badly paved and littered streets, dilapidated buildings, billboard clutter, inept land use, and air, water, and noise pollution. In addition, sediment has many direct and indirect effects on streams that may be either part of or very remote from the urban environment. Sediment, for example, is widely recognized as a pollutant of streams and other water bodies. Much of the disturbed soil in urban construction areas erodes and becomes sediment in streams; the sediment damages water-control works and aquatic habitat, degrades water quality, increases flood damages, and lowers the environmental attractiveness. During the process of stabilization of an area after construction, streams tend to erode their beds and banks as a result of increased runoff. Documentation of erosion sources and amounts, of sediment concentration in runoff, of stream-channel changes, and of the location and amounts of deposition together with an economic analysis of sediment damages and a pertinent research program provides the knowledge needed to find the best solutions to a wide variety of existing and future urban sediment problems. (Knapp-USGS)
W71-00393

4D. Watershed Protection

EFFECTS OF GROUNDWATER SEEPAGE ON FLUVIAL PROCESSES,
Wisconsin State Univ., Oshkosh. Dept. of Geology; and North Dakota Univ., Grand Forks. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W71-00028

VATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02A.
W71-00072

VATER-REPELLENT SOILS AND WETTING AGENTS AS FACTORS INFLUENCING EROION,
orest Service (USDA), Berkeley, Calif. Pacific outhwest Forest and Range Experiment Station; nd California Univ., Riverside. Dept. of Soils and lant Nutrition.
or primary bibliographic entry see Field 02G.
/71-00157

HANNEL-SCARP FORMATION IN WESTERN ORTH DAKOTA,
eological Survey, Grand Forks, N. Dak.
homas M. Hamilton.
hapter C for sale by the Superintendent of Docuents, US Government Printing Office, Washingon, DC, 20402--Price $3.25. In: Geological Survey esearch 1970, Chapter C: Geological Survey rofessional Paper 700-C, p C229-C232, 1970. 4 p, fig, 6 ref.

escriptors: *Stream erosion, *Alluvial channels, Gully erosion, *Small watersheds, *North akota, Channel erosion, Alluvium, Rainfall-runoff relationships, Channel morphology, Arid nds, Sediment transport, Sedimentation, Vegetaon effects.
dentifiers: Channel scarps.

reconnaissance of the present gully system and alley surfaces of small drainage basins in western orth Dakota indicates that channel-scarp formaon may most often be the result of one of three eneral conditions. These conditions are: (1) cutoff the downvalley toe of alluvial fill in tributaries by ncroachment of a migrating main channel; (2) utting on a local reach of steeper gradient as a esult of (a) an extreme flood, (b) a shift toward reater precipitation causing channel degradation n the steeper reach, or (c) short time-separation etween two storms; and (3) piping collapse. (Kapp-USGS)
/71-00185

VALUATION OF A SINGLE LAYERED RADED GRAVEL AS A PROTECTIVE ILTER,
lissouri Water Resources Research Center, olumbia.
lifford D. Muir.
vailable from NTIS as PB-195 084, $3.00 in aper copy, $0.95 in microfiche. Completion Reort, Missouri Water Resources Research Center, ug 27, 1970. 10 p, 101 tab, 2 fig, 7 ref, 2 append. WRR Project A-028-MO (2).

escriptors: Erosion, Seepage, Slope protection, Erosion control, Road banks, *Filters, Gravels, orous media.
dentifiers: *Gravel layer, Particle migration.

laboratory study was conducted to evaluate the asibility of using a random graded single layer of ravel as a protective filter against embankment rosion due to seepage. This evaluation was based n the observation of movement of particles from a ne sand layer into filters with considerable variaon in gradation. Also varied were the quantity and rection of flow. Forty one tests gave over six hunred individual penetration depths. These tests indicated that an increased thickness of filter layer an be used to replace fineness of gradation. Correlation between penetration depths for all gradaons was obtained using an approximated average ydraulic radius for each filter. Te data on penetraon patterns and relationships between penetration epth and average hydraulic radius should be helpul in the design of a random graded single layer rotective filter.
/71-00413

BENEFICIAL USE OF WATERSHEDS (IMPROVEMENT OF WATERSHED MANAGEMENT; NECESSITY FOR NEW WATER-ALLOCATION POLICY TO ACCOUNT FOR THE INCREASE IN RECREATIONAL USE).
For primary bibliographic entry see Field 06E.
W71-00487

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

REVEALING BY PHYSICAL PROCEDURE THE SHORT-DURATION FLUCTUATIONS IN THE DENSITY OF VEGETATION OF MOUNTAIN STREAMS. DEFINITION OF A NEW BIOLOGICAL TEST IN WATER ANALYSIS, THE BIOCHEMICAL DEMAND FOR MINERAL SALTS (IN FRENCH),
For primary bibliographic entry see Field 02I.
W71-00104

QUALITY AND SEASONAL FLUCTUATION OF HEADWATER STREAMS IN MONTANA,
Montana Forest and Conservation Experiment Station, Missoula.
George F. Weisel, and Robert L. Newell.
Available from NTIS as PB-194 756, $3.00 in paper copy, $0.95 in microfiche. Bulletin 38, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, Montana, Aug. 1970. 16 p, 6 tab, 8 fig, 18 ref. OWRR Project No. A-018-MONT (2).

Descriptors: *Water quality, *Pollutant Identification, *Turbidity, Dissolved solids, Hardness (Water), Alkalinity.

The water quality of 25 headwater creeks and the Blackfoot River, all tributaries to the Clark Fork of the Columbia, was investigated. Most of the qualities analyzed exhibit definite seasonal trends. Turbidity, total residue, and percent of residue from settleable solids are the most variable, particularly in watersheds which have been roaded and logged. The pH values are generally 7.4--8.6. The water is most basic during summer months and becomes less so during snow and rain runoff. The only acid stream was one which receives seepage from old mine tailings. The levels of total hardness, calcium hardness, and alkalinity decreases with increased runoff. Total dissolved solids, calcium, magnesium, bicarbonates, and chlorides are at highest levels during low water. They are derived mostly from water percolated through surface runoff. In general, the spring fed streams and streams used for irrigation contain the greatest amounts of dissolved materials. The streams maintain a high level of dissolved oxygen seldom less than 8 mg/l. Photosynthesis and nocturnal respiration are unimportant in effecting the amount of dissolved oxygen in these mountain streams. Carbon dioxide is present in amounts less than 2 mg/l.
W71-00142

MERCURY BIBLIOGRAPHY,
Eastman Kodak Co., Rochester, N.Y. Kodak Park Div.
Don H. Anderson.
Eastman Kodak Company, Kodak Park Division Mercury Bibliography, August 10, 1970. 1 p, 9 ref.

Descriptors: *Chemical analysis, *Trace elements, *Poisons, *Laboratory tests, Water analysis, Pollutant identification, Photometry, Flame photometry.
Identifiers: Mercury, Mercury analysis.

A brief bibliography of nine reports and background information on detection and analysis of trace amounts of mercury is available from Eastman Kodak Company, Rochester, New York, 14650. Reprints of reports on lab procedure originated by Kokak are also available. (See also W71-00168 through W71-00172) (Knapp-USGS)
W71-00167

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY,
Eastman Kodak Co., Rochester, N.Y.
Albert E. Ballard, and C. D. W. Thornton.
Industrial and Engineering Chemistry, Vol 13, No 12, p 893-897, December 15, 1941. 5 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

Mercury resonance radiation of wave length 2537 angstroms is absorbed by mercury vapor. If a constant source of this radiation is placed at one end of a tube and a narrow-band photoelectric cell sensitive to this line is placed at the other end, a microammeter, connected through an amplifying system to the photocell, will indicate the amount of light falling on the cell. If the tube contains mercury vapor, some of the light will be absorbed and the microameter will give a different reading from that given when no mercury vapor is in the light path. The method presented allows the determination of 0.02 to 0.60 microgram of mercury in 150 to 400 cc of solution. Using a battery of recovery units, an operator can make 25 determinations per day. The method may be used with water-miscible solvent mixtures and with solutions from the digestion of solid organic materials. It is applicable to the estimation of mercury in biological materials after suitable preliminary digestive treatment. (See also W71-00167) (Knapp-USGS)
W71-00168

PHOTOMETRIC METHOD FOR ESTIMATION OF MINUTE AMOUNTS OF MERCURY - USE OF G.E. GERMICIDAL ULTRAVIOLET INTENSITY METER,
Eastman Kodak Co., Rochester, N.Y.
C. W. Zuehlke, and A. E. Ballard.
Analytical Chemistry, Vol 22, p 953-954, July 1950. 2 p, 3 fig, 1 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

Instructions are given for constructing an inexpensive photometric mercury-detection device using commercially available parts. The instrument determines 0.02 to 0.60 micrograms of mercury in 150 to 400 cc of solution. The method may be used with water-miscible solvent mixtures and with solutions from the digestion of solid organic and biological materials. (See also W71-00167) (Knapp-USGS)
W71-00169

PHOTOMETRIC MERCURY ANALYSIS - CORRECTION FOR ORGANIC SUBSTANCES,
Eastman Kodak Co., Rochester, N.Y. Research Labs.
Albert E. Ballard, David W. Stewart, Warren O. Kamm, and Carl W. Zuehlke.
Analytical Chemistry, Vol 26, p 921-922, May 1954. 2 p, 2 tab, 2 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

Methods are given for correcting for organic substances interfering with analysis of mercury by absorption photometry. After the reading using the mercury photometer has been obtained, the cell is immediately transferred to a spectrophotometer, and a second reading of absorbance is made at 2537 angstroms. Mercury vapor has no appreciable absorbance under these conditions, since it absorbs only a narrow line at 2537 angstroms, which represents a small fraction of the total energy in the

wave lengths represented in the effective band. Interfering organic substances, on the other had, generally have rather broad absorption bands and produce a substantial absorbance both in the mercury photometer and as measured by the other instrument. Accordingly, the amount of extraneous absorbance at 2537 angstroms can be approximately measured and applied as a correction to the mercury reading. (See also W71-00167) (Knapp-USGS)
W71-00170

SENSITIVE SIMPLE MERCURY PHOTOMETER USING MERCURY RESONANCE LAMP AS A MONOCHROMATIC SOURCE,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
Clement Ling.
Analytical Chemistry, Vol 39, No 7, p 789-804, June 1967. 7 p, 4 fig, 2 tab, 13 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

A sensitive mercury photometer using a mercury resonance lamp as a source of sharp monochromatic resonance radiation is described. Parameters pertaining to sensitivity are discussed. Null method of increasing the sensitivity is also described. The potential application of the photometer in mercury isotopic analysis is suggested. Method for correcting nonatomic absorption is also proposed by means of which mercury may be analyzed in the presence of interfering substances. The instrument is compact enough to be portable. The detection limit (for 1% absorption) of the single beam system is 0.3 nanogram. (See also W71-00167) (Knapp-USGS)
W71-00171

PORTABLE ATOMIC ABSORPTION PHOTOMETER FOR DETERMINING NANOGRAM QUANTITIES OF MERCURY IN THE PRESENCE OF INTERFERING SUBSTANCES,
Kodak (Australasia) Pty Ltd., Coburg (Australia). Research Labs.
Clement Ling.
Analytical Chemistry, Vol 40, No 12, p 1876-1878, October 1968. 3 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Laboratory tests, *Chemical analysis, *Water analysis, *Trace elements, Pollutant identification, Poisons, Photometry.
Identifiers: Mercury, Mercury analysis.

A sensitive mercury photometer using a mercury resonance lamp as a source of sharp monochromatic resonance radiation is described. Parameters pertaining to sensitivity are discussed. Null method of increasing the sensitivity is also described. The potential application of the photometer in mercury isotopic analysis is suggested. Method for correcting nonatomic absorption is also proposed by means of which mercury may be analyzed in the presence of interfering substances. The instrument is compact enough to be portable. The detection limit (for 1% absorption) of the single beam system is 0.3 nanogram. (See also W71-00167) (Knapp-USGS)
W71-00172

THE USE OF AUTOMATED TITRIMETRY FOR ANALYSES OF NATURAL WATER,
Geological Survey, Denver, Colo.; and Geological Survey, Oklahoma City, Okla.
For primary bibliographic entry see Field 02K.
W71-00183

AUTOMATED POTENTIOMETRIC DETERMINATION OF CHLORIDE IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W71-00184

BIOCHEMICAL-OXYGEN-DEMAND, DISSOLVED-OXYGEN, SELECTED-NUTRIENTS, AND PESTICIDE RECORDS OF TEXAS SURFACE WATERS, 1969 WATER YEAR,
Geological Survey, Austin, Tex.
Jean A. Schulze, Alton J. Dupuy, and Douglas B. Manigold.
Texas Water Development Board Report 120, September 1970. 22 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Sampling, *Surface waters, *Texas, *Biochemical oxygen demand, *Dissolved oxygen, Nutrients, Pesticide residues, Water pollution sources, Water analysis, Water quality, Data collections.
Identifiers: Water quality records (Tex).

A network of daily and periodic chemical-quality stations on streams in Texas is operated by the U.S. Geological Survey in cooperation with the Texas Water Development Board and with other State, Federal, and local agencies. Analyses of water from this network include the principal inorganic constituents and related properties. BOD (biochemical oxygen demand), dissolved oxygen, and selected nutrients and pesticides are also determined at strategically located sites on most of the principal streams. Records of these periodic determinations were compiled through September 1968. (Knapp-USGS)
W71-00202

THE STATUS OF THERMAL DISCHARGES ON THE PACIFIC COAST,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
Wheeler J. North, and James R. Adams.
Chesapeake Science, Vol 10, No 3 and 4, p 139-144, Sept-Dec 1969. 2 fig, 3 tab.

Descriptors: *Thermal pollution, Thermal powerplants, Cooling water, Temperature, Regression analysis, Stratification, Water pollution sources, California, *Tidal waters.
Identifiers: Thermal discharge.

Thermal power stations that discharge waste heat from cooling water into tidal areas of California represent 85% or 16,982 megawatts (MW) of the total state thermal power capacity in 1969. The generation on tidal areas in Oregon is 169.5 MW, and in Washington is 77.9 MW. The surface area influenced in 35 measurements at 9 power station discharges was used to calculate a regression equation in which generation in MW was equated to surface area raised above normal temperature in acres. The linear regression for areas raised 2F above normal was Y — 104.422 .. .0902011 X, while the equation for areas raised 10F above normal was Y — 2.77812 .. .0126561 X. If all thermal stations in California were operated at maximum capacity, a total of 5.86 square miles of surface water would be raised 2F above normal, and 0.41 square miles would be raised 10F above normal, according to the regression equations. California has 400 square miles of bays and estuaries into which power stations discharge and a shoreline of 1205 miles. The average load factor (ratio of actual operating load to total capacity) at California tidal stations was 56% in 1966. (Upadhyaya-Vanderbilt)
W71-00242

THE DIURNAL CURVE IN ESTIMATES OF PRIMARY PRODUCTIVITY,
Federal Water Pollution Control Administration, Alameda, Calif. Southwest Region.
Charles M. Seeley.
Chesapeake Science, Vol 10, No 3 and 4, p 322-326, Sept-Dec 1969. 1 fig, 24 ref.

Descriptors: *Primary productivity, *Dissolved oxygen, Respiration, Photosynthesis, Water pollution effects.
Identifiers: *Diurnal curve, Saturation deficit, Diffusion coefficient, Aquatic system.

Changes in dissolved oxygen which occur in an aquatic system over a period of time are normally the result of: Photosynthetic production by aquatic plants within the water mass, respiration of aquatic plants, animals and bacteria, diffusion of oxygen into or out of the water, and advective gain or losses due to displacement of a water mass. Two principal approaches of the procedure are available to the investigator, the single-station method and the upstream-downstream method. The single-station method is described in this paper. Replicate sample for dissolved oxygen (mg/l) and water temperatures (C) are taken at intervals of three hours or less over a 24 hour period. Dissolved oxygen concentration and temperature data are plotted. Oxygen saturation values are determined and are graphed. An oxygen rate of change curve is constructed. Two points in time, the first shortly before sunrise and the second shortly after sunset (qm and qe) are chosen. The diffusion coefficient per volume, k, is calculated as k — 100 (qm - qe/Sm - Se) where qm and qe are the rate of change and Sm and Se are the percentage saturation deficit, before and after sunrise, respectively. Steps for obtaining the corrected rate-of-change curve, respiration rate and gross community photosynthesis are also described. (Upadhyaya-Vanderbilt)
W71-00252

EVALUATION OF CULTURE MEDIA FOR THE ISOLATION OF SALMONELLAE FROM FECES,
Iowa State Univ., Ames. Dept. of Veterinary Microbiology and Preventative Medicine.
R. M. Sharma, and R. A. Packer.
Journal of Applied Microbiology, Vol 18, No 4, p 589-595, 1969. 6 tab, 25 ref.

Descriptors: *Salmonella, *Farm wastes, *Cultures, Cattle, Hogs, *Isolation.
Identifiers: Brilliant Green MacConkey Broth, Tetrathionate Broth, Selenite Broth.

A study conducted on 300 fecal samples from a cow and a pig, each artificially contaminated with approximately four Salmonella organisms revealed that, of the three enrichment broths used in conjunction with the three selective media, the maximum number of isolations were obtained with Brilliant Green MacConkey broth (BGMB), followed by those obtained with tetrathionate (TTB), and the least with selenite broth. The combination of BGMB with Brilliant Green neutral red-lactose agar (BGNRLA), and TTB with desoxycholate citrate agar (DCA) gave an equal number of isolations. Of the three selective media used in conjunction with the three enrichment broths, the maximum number of recoveries were obtained on BGNRLA, followed by those on DCA, and least number of isolations on bismuth sulfite agar (BSA). The combination of selenite F broth-BSA appeared to be somewhat inhibitory for the growth of Salmonella organisms. Of the two selective media combinations, the DCA-BGNRLA combination yielded the highest number of isolations. The use of all three selective media gave still better results. (Miner-Iowa State)
W71-00325

IDENTIFICATION AND EXCRETION OF ESTROGEN IN URINE DURING THE ESTROUS CYCLE OF THE EWE,
Purdue Univ., Lafayette, Ind. Dept. of Animal Sciences.
E. D. Plotka, and R. E. Erb.
Journal of Animal Science, Vol 29, No 6, p 934-939, 1969. 2 fig, 1 tab, 27 ref.

Descriptors: Farm wastes, *Sheep, *Urine, Organic compounds, *Chromatography.
Identifiers: Estrone, *Estrogen, Pregnant ewes.

Estrone was identified in urine of the non-pregnant ewe by comparing its behavior to crystalline standard estrone and by its failure to separate from added 14C-estrone through solvent partitioning, paper chromatography, successive thin-layer chromatography in different systems, gas-chromotography, (GLC) on three columns, derivative forma-

on and chromatography of the derivatives. The ighest average rate of excretion of estrone and es- adiol occurred during estrus averaging 394 and 79 ug./24 hr. as compared to the lowest rates of) and 17 ug./hr., respectively, the second day ter estrus. Expressing excretion rate as ng/mg. of inary creatine was highly correlated (r-0.97- 98) to total excretion based on total collection of ine for 24 hours. (Miner-Iowa State)
71-00330

RAPID AND SIMPLE METHOD FOR THE ETECTION AND ISOLATION OF SAL- ONELLA FROM MIXED CULTURES AND OULTRY PRODUCTS,
wa State Univ., Ames. Dept. of Food Technolo- .
aniel Y. C. Fung, and Allen A. Kraft.
oultry Science, Vol 49, No 1, p 46-54, 1970. 1 fig, tab, 7 ref.

escriptors: *Isolation, *Salmonella, *Poultry, Cultures, Farm wastes.
entifiers: Poultry products, Motility flask, Con- ntrations, Strains.

his report deals with results obtained using a new pid method of Salmonellae detection and isola- on in mixed cultures, turkey and chicken oducts, and whole eggs. The paper describes a mple system, combining biochemical and physical operties of Salmonella, which can detect small mbers of Salmonella in the presence of large mbers of competitive organisms. Motility multi- yered agar flasks were used in the test. Typical mplete Salmonella reactions were obtained in e control flask as early as 17-36 hours of incuba- on, as compared with 48-96 hours by conven- onal methods. This system has the potential as a mple and rapid method for large scale screening st for Salmonellae in a variety of commercial od products. (White-Iowa State Univ)
71-00336

TREAM SURVEYS PINPOINT POLLUTION,
anadian Industries Ltd., New Toronto (Ontario).
orman E. Cooke.
dustrial Water Engineering, Vol 7, No 9, p 31-33, ptember 1970. 3 p, 4 fig, 4 ref.

escriptors: *Water pollution control, *Monitor- g, *Bioindicators, Waste disposal, Water pollu- on sources, Sampling, Statistical methods, Sur- ys, Data collections, Bottom sediments, Aquatic bitats, Industrial wastes.
entifiers: Water pollution monitoring.

sing quality control charts on the responses of mple mud-dwelling animals to the toxic sub- nces enables detection of incipient contamina- on in receiving waterways, both polluted and un- lluted. To detect and recognize a meaningful gnal in the presence of a large amount of noise is ways a difficult task. Basing effluent quality con- ol charts on the differences in the number of imals found at locations upstream and wnstream from a plant outfall permits one to de- ct a significant change caused by material scharged through the outfall despite very large ctuations in the number of animals caused by ndom discharges of polluting materials upstream. napp-USGS)
71-00348

ETERMINATION OF SUBMICROGRAM UANTITIES OF MERCURY IN LAKE ATERS,
epartment of Energy, Mines and Resources, rlington (Ontario). Canada Center for Inland aters.
u-Kee Chau, and Hirohumi Saitoh.
nvironmental Science and Technology, Vol 4, No , p 839-841, October 1970. 3 p, 2 fig, 1 tab, 12 f.

Descriptors: *Trace elements, *Heavy metals, *Pollutant identification, *Water pollution sources, *Lakes, Chemical analysis, Analytical techniques, Water analysis, Water chemistry, Poisons, Industrial wastes, Laboratory tests, Spectrophotometry.
Identifiers: Mercury.

A simple and sensitive method for the determination of submicrogram amounts of mercury in lake water was developed by combination of concentration by dithizone extraction and gas-phase atomic absorption. The mercury was first extracted by dithizone, back extracted by hydrochloric acid, and then converted to vapor by a reduction-aeration reaction. Hg, Hg (I), Hg (II), and some organomercuric compounds were extracted by the present procedure. A sensitivity of 0.008 micrograms per liter (0.008 ppb) was achieved for water analysis. Standard deviations of 0.0087 and 0.0042 were found for lake water samples containing 0.478 and 0.048 micrograms per liter of Hg, respectively. (Knapp-USGS)
W71-00355

GEOTHERMAL WASTES AND THE WATER RESOURCES OF THE SALTON SEA AREA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 02K.
W71-00356

HUMIC SUBSTANCES: FULVIC ACID-DIALKYL PHTHALATE COMPLEXES AND THEIR ROLE IN POLLUTION,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
For primary bibliographic entry see Field 05B.
W71-00377

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER.
For primary bibliographic entry see Field 05B.
W71-00397

RAPID PROCEDURES TO MONITOR WATER FOR POTABILITY,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
Arnold R. Slonim.
Available from NTIS as AD-705 445, $3.00 in paper copy, $0.95 in microfiche. Aerospace Medicine, Vol. 39, No. 11, November 1968, p 1182-1189.
Identifiers: *Water supplies, Monitors, *Water pollution, Measurement, Accelerated testing, infrared equipment, Smell, Taste, Colors, pH, Particles, Organic compounds, Microbiology, Radiological contamination, Potable water, Turbidity.

The latest developments in methodology for monitoring aerospace water supplies for potability are described. Analytical techniques are emphasized that meet some of the following criteria: reproducibility, sensitivity of measurement, rapidity of analysis, instrumentational capability, and potential for aerospace monitoring. The leading instrumentational methods are the two recent combustion/infrared techniques for measuring organic pollution, one for total organic carbon and the other for chemical oxygen demand, and bioluminescence for determining microbiological contamination of water samples. Other potentially sound methods as well as future trends for aerospace applications are discussed.
W71-00455

AUTOMATED POTENTIOMETRIC TECHNIQUES FOR THE ON-SITE MONITORING OF ION CONCENTRATIONS IN WATER,
Missouri Univ., Columbia. Dept. of Chemistry.
Stanley E. Manahan.
Available from NTIS as PB-195 167, $3.00 in paper copy, $0.95 in microfiche. OWRR Completion Report, 1970. OWRR Project A-024-MO (11).

Descriptors: *Analytical techniques, *Water analysis, *Nitrates, *Electrodes, Ions, Fluorides, Algae, Volumetric analysis, Water chemistry.
Identifiers: Ion-selective electrodes, Standard addition, Potentiometry, Interfering ions.

The characteristics of the nitrate electrode - fluoride electrode cell without liquid junction were investigated for applicability to nitrate ion analysis. In addition to enabling accurate nitrate analysis, the cell was found to be useful for examining the effects of interfering ions. An attempt was made to use the nitrate electrode in following nitrate ion uptake by algal cultures. The algae interfere to a certain extent with the electrode response. Using knowledge gained from research under this grant a potentiometric nitrate analysis capability has been set up at the University of Missouri Environmental Trace Substances Laboratory.
W71-00474

TREATMENT OF ACID MINE DRAINAGE OF REVERSE OSMOSIS.
Rex Chainbelt, Inc., Milwaukee, Wis.

Available from NTIS as PB-195 200, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.55. I67.13/4:14010 DYK 03/70. Water Pollution Control Research Series 14010 DYK 03/70, March 1970. 35 p, 12 tab, 11 fig, 15 ref, append. FWPCA Project 14010 DYK.

Descriptors: *Reverse osmosis, *Acid mine water, *Mine drainage, *Demineralization, Waste water treatment, Osmosis, Pennsylvania, Dissolved solides, Iron, Manganese.
Identifiers: Shickskinney (Pennsylvania).

This report documents a study on the treatment of acid mine drainage by reverse osmosis. The objective of the study was to determine the feasibility of utilizing reverse osmosis to abate pollution due to acid mine drainage, and produce a water which could be used by industry or as a municipal water supply. A test site in Shickshinny, Pennsylvania was selected as a source of acid mine water. A sample of this water was tested in a laboratory reverse osmosis unit to determine the design parameters for a 10,000 gallon per day demonstration unit. This unit was operated for a period of 35 days on acid mine drainage as received from the Mocanaqua discharge near Shickshinny. Operation during this period was continuous, i.e., 24 hours per day. Daily samples of feed water, product water, and waste concentrate were analyzed to determine the effectiveness of the demonstration unit. The results obtained during the demonstration period indicated that the reverse osmosis process has potential application in acid mine drainage treatment. A high quality water was produced which was suitable for use by industries or municipalities with a minimum of additional treatment. There are, however, operational problems which must be solved prior to utilzing reverse osmosis on a large scale. These include maintenance of high permeation rates through the membrane by reducing membrane fouling and determination of the optimum flow sheet for an acid mine treatment system utilizing reverse osmosis. It is recommended that: (1) The mechanisms and method of reducing iron fouling of reverse osmosis membranes be evaluated in the laboratory using synthetic acid mine water; (2) The optimum flow sheet for treating acid mine drainage by reverse osmosis be determined by laboratory evaluation of synthetic acid mine water; and (3) The laboratory data be confirmed by a field evaluation period.
W71-00477

5B. Sources of Pollution

A STUDY OF GROUNDWATER POLLUTION BY SALT.

Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-34. 13 p.

Descriptors: *Water pollution sources, *Mine wastes, *Saline water intrusion, *Aquifers, *Alluvial channels, Salts, Saline water.
Identifiers: France, Rhine Valley, Alsace.

Pollution by brines of a groundwater in the Eastern part of France is described. The origin and intensity of the phenomenon, the measurement program, and the theoretical schemes which have been used to analyze and to predict the development of the pollution are discussed. The study was limited to the Rhine's alluvial aquifer in Alsace, a province of northeastern France. Its area is over 5000 square kilometers and its thickness varies between 0 and more than 200 meters. The beds consist of highly permeable Quaternary alluvial deposits (permeability about 0.001 m/sec) lying on an Oligocene marl substratum which is, in places, also covered by a Pliocene stratum of sandy clay. An increase of the sodium chloride content of the groundwater has been noticed, and it is ascribed to the presence of important potash mine-workings in the southern part of the district. (Knapp-USGS)
W71-00001

EFFECTS OF DENSITY DIFFERENCES ON LATERAL MIXING IN OPEN-CHANNEL FLOWS,

California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources.
Edmund A. Prych.
California Institute of Technology, W M Keck Laboratory of Hydraulics and Water Resources Report No KH-R-21, May 1970. 225 p, 76 fig, 15 tab, 37 ref, append. FWQA Grants 16000 DGY and 16070 DGY.

Descriptors: *Mixing, *Turbulent flow, *Diffusion, *Dispersion, *Path of pollutants, Open channel flow, Estuaries, Streams, Streamflow, Stratified flow, Density, Density stratification, Model studies, Hydraulic models, Mathematical models, Turbulence.
Identifiers: Longitudinal dispersion, Lateral dispersion.

Lateral mixing of tracer fluids were studied in turbulent open-channel flows in which the tracer and ambient fluids have different densities. Longitudinal dispersion in flows with longitudinal density gradients were investigated also. Lateral mixing was studied in a laboratory flume by introducing fluid tracers at the ambient flow velocity continuously and uniformly across a fraction of the flume width and over the entire depth of the ambient flow. When there was a difference in density between the tracer and the ambient fluids, lateral mixing close to the source was enhanced by density-induced secondary flows; however, far downstream where the density gradients were small, lateral mixing rates were independent of the initial density difference. Normalized variance is a function of only three dimensionless numbers, which represent: (1) the x-coordinate, (2) the source width, and (3) the buoyancy flux from the source. Predicted longitudinal salinity distributions in an idealized laboratory estuary agree well with published data. (Knapp-USGS)
W71-00005

PREDICTING CONCENTRATION PROFILES IN OPEN CHANNELS,

Geological Survey, Fort Collins, Colo.; and Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 08B.
W71-00020

CIRCULATION, EFFLUENT DIFFUSION, AND SEDIMENT TRANSPORT, MOUTH OF SOUTH PASS, MISSISSIPPI RIVER DELTA,

Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright.
Louisana State University Coastal Studies Institute Technical Report No 84, June 30, 1970. 56 p, 24 fig, 6 tab, 91 ref. ONR Project No N R 388 002.

Descriptors: *Mississippi River, *Deltas, *Sediment transport, *Saline water intrusion, Water circulation, Currents (Water), Mixing, Disperison, Suspended load, Density stratification, Density currents, Bed load, Turbidity.
Identifiers: Mississippi River delta.

A study was conducted at the mouth of South Pass, Mississippi River, to ascertain the influence exerted by interaction between effluent and ambient fluids; tides; waves; winds; bottom topography and channel mouth geometry; regional coastal currents; horizontal and vertical density gradients; and hydrologic regime of the Mississippi River. Downstream flow within the pass, as well as efflux seaward of the mouth, was swiftest during ebbing tide. Salt-wedge circulation in the lower reaches of the pass was characterized by upstream flow at flooding tide and downstream flow at ebbing tide. Statistical analyses indicated that river stage, tide, sea state, and position relative to the distributary mouth bar exert a significant influence on vertical stratification and mixing seward of the mouth. Stratification was most pronounced during high river stage, flooding tide, calm seas, and along the effluent axis, and weakened progressively from the mouth to the bar crest. In the fluvial-marine interaction zone immediately seward of the mouth, the freshwater effluent spread laterally as a relatively discrete and homogeneous mass. Suspended-sediment concentration varied directly with river stage and inversely with temperature. (Knapp-USGS)
W71-00036

SATREN V HADER CO-OPERATIVE CHEESE FACTORY (ABATEMENT OF NUISANCE CAUSED BY DISCHARGE OF INDUSTRIAL WASTE).

For primary bibliographic entry see Field 06E.
W71-00087

EUTROPHIC EVALUATION OF A SMALL MULTI-LAND USE WATERSHED,

Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-00141

EFFECTS OF URBANIZATION ON THE QUALITY OF SELECTED STREAMS IN SOUTHERN NASSAU COUNTY, LONG ISLAND, NEW YORK,

Geological Survey, Mineola, N.Y.
Ellis Koch.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C189 -C192, 1970. 4 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Urbanization, *Water pollution sources, *New York, *Water quality, Streamflow, Surface waters, Runoff, Nitrates, Industrial wastes, Domestic wastes, Sewage disposal, Path of pollutants.
Identifiers: Long Island (NY), Nassau County (NY).

The water quality of the streams in southern Nassau County has diverged noticeably from natural conditions because of extensive urbanization. The quality of two streams in sparsely populated areas in Suffolk County was compared with the quality of three streams in moderately to densely populated parts of Nassau County. The estimated load of dissolved solids of all the southern Nassau County streams presently is about 10.5 tons per day greater than the estimated load under natural conditions. Furthermore, analysis of the data for certain constituents directly affected by man shows that the detergent content of the three streams in Nassau County ranges from County streams; the nitrate content is 14 times that of the Suffolk County streams; and the dissolved-solids content is about 3 to 4 times that of the Suffolk County streams. (K-napp-USGS)
W71-00175

USE OF CHANNEL SLOPE AND DISCHARGE TO DETERMINE REAERATION COEFFICIENTS FOR THE ELKHORN RIVER IN NEBRASKA,

Geological Survey, Lincoln, Nebr.
K. A. MacKichan, Neil G. Stuthmann, and Ray Bentall.
Chapter C for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter C: Geological Survey Professional Paper 700-C, p C193 - C197, 1970. 5 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Reaeration, *Streamflow, *Channel morphology, *Slopes, *Discharge (Water), Nebraska, Velocity, Turbulent flow, Biodegradation, Self-purification, Waste assimilative capacity, Dissolved oxygen, Frequency analysis.
Identifiers: Elkhorn River (Nebr).

The reaeration coefficient, k, of a stream at a given point can be computed from an empirical formula expressing k in terms of mean velocity and mean depth. As both velocity and depth vary with discharge and channel slope, k for a given stream obviously can be expressed equally well in terms of discharge and slope. An equation is presented whereby k for any point along the Elkhorn River in Nebraska can be computed, using channel-slope data, for minimum 7-day discharges having different recurrence intervals. (Knapp-USGS)
W71-00176

NOTES ON THE POSITION OF A PHOSPHATE ZONE AND ITS RELATION TO GROUNDWATER IN COASTAL GEORGIA,

Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 02F.
W71-00178

EFFECTS OF A CONCENTRATED ACID ON WATER CHEMISTRY AND WATER USE IN A PLEISTOCENE OUTWASH AQUIFER,

Geological Survey, Louisville, Ky. Water Resources Div.
Hayes F. Grubb.
Groundwater, Vol 8, No 5, p 4-7, September-October 1970. 4 p, 9 fig, 2 tab, 3 ref.

Descriptors: *Water pollution sources, *Industrial wastes, *Groundwater movement, *Recharge, *Surface-groundwater relationships, Malenclaves, Path of pollutants, Acids, Leaching, Chlorides, Glacial drift, Aquifers, Ohio River, Kentucky.
Identifiers: Hydrochloric acid.

A break in a waste-discharge line at the same time as a 49-foot rise in stage of the Ohio River in March 1967 allowed hydrochloric acid to enter the Pleistocene outwash aquifer used by a Kentucky industry. Chloride concentrations in excess of 30,000 mg/liter were observed in the water discharged from the industrial well nearest the break in the waste-discharge line. By March 1968, the well nearest the acid source was abandoned, the remaining two wells near the river were used in supplemental capacity and a fourth well 1,500 feet from the river plus a new well were the primary water sources. Fluctuations of chlorides in an industrial well near the river for a 16-month period indicate a persistent body of highly mineralized water near the acid source. Movement of this water

ody appears to be regulated at low river stages by ne inclined surface of the New Albany Shale edrock. (Knapp-USGS)
/71-00194

STUDY OF THE DISPERSION AND FLUSHNG OF WATER-BORNE MATERIALS IN THE ORTHWEST BRANCH OF BALTIMORE HAROR, AND THE RELATIONSHIP BETWEEN HESE PHYSICAL PROCESSES AND THE ATER QUALITY OF THE INNER HARBOR,
ohns Hopkins Univ., Baltimore, Md. Chesapeake ay Inst.
obert E. Wilson.
ohns Hopkins University Chesapeake Bay Initute Technical Report 64, Mar 1970. 101 p, 38 g, 20 ref, 5 append.

escriptors: *Tracers, *Dye releases, *Mathemati-l models, *Path of pollutants, Model studies, aste assimilative capacity, Currents (Water), Difsion, Mixing, Water circulation, Advection, omputer programs.
entifiers: Baltimore Harbor (Md).

ased on this model, circulation in the Branch may e classified into 4 distinct types according to the rection of net volume flow. Circulation within the anch is very transient and changes rapidly from ne type to another. Modal values for volume flow nd diffusive exchange may be determined for each the basic circulation types. (Knapp-USGS)
71-00200

IOCHEMICAL-OXYGEN-DEMAND, DISOLVED-OXYGEN, SELECTED-NUTRIENTS, ND PESTICIDE RECORDS OF TEXAS SURACE WATERS, 1969 WATER YEAR,
eological Survey, Austin, Tex.
or primary bibliographic entry see Field 05A.
71-00202

ANITARY BIOLOGICAL CONDITIONS, ROCESSES OF SELF-PURIFICATION AND ONTENT OF TRACE ELEMENTS IN THE ATERS OF THE RIVERS OF THE SHEKIAKATALY ZONE OF AZERBAYDZHAN,
F. Akhundov, T. V. Grekalova, N. I. Karayeva, nd S. M. Tenengol'ts.
ranslation of Gidrobiologicheskiy Zhurnal, Vol 5, o 2, 1969. Hydrobiological Journal, Vol 5, No 2, 29-32, 1969. 4 p, 3 tab, 4 ref.

escriptors: *Self-purification, *Reaeration, Rivers, *Path of pollutants, Industrial wastes, Oxgen demand, Oxygen sag, Waste assimilative apacity.
entifiers: *USSR, Azerbaydzhan.

ydrochemical and microbiological investigations ere made of the rivers of the Sheki Zakataly zone Azerbaydzhan. The principal rivers are polluted industrial wastes, but they are capable of self purification. The total quantity of microbes is as much 12 million colonies/milliliter. Analysis of the hemical composition of the waters of the rivers inestigated places them in the bicarbonate class. he waters of these rivers are either weakly or oderately mineralized. The high intensity of selfrification in mountain rivers is associated with ood aeration due to mixing. Its magnitude does ot depend upon the turbulence of the current: in e case of mountain currents with a rapid flow lf-purification is equal (at 15 deg C) to 0.74 as ompared with the case of lowland rivers in which is about 0.18. (Knapp-USGS)
71-00220

EASONAL DYNAMICS OF THE REDUCING UGAR CONTENT OF WATER IN THE KIEV ESERVOIR AND INFLOWING RIVERS,
kademiya Nauk URSR, Kiev. Instytut idrobiologii.
. A. Yenaki.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 3, 1969. Hydrobiological Journal, Vol 5, No 3, p 47-50, 1969. 4 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Reservoirs, *Eutrophication, *Carbohydrates, *Nutrients, *Biodegradation, Algae, Bacteria, Aquatic microorganisms, Sampling, Water analysis, Water quality, Pollutant identification.
Identifiers: Kiev Reservoir (USSR).

Carbohydrate-like compounds in natural waters play an important role in processes which occur within reservoirs and in particular in processes of formation and transformation of organic substances in natural waters. Monthly determinations were made in 1965 and 1966 of the reducing sugar content of water in the Kiev reservoir and the rivers flowing into it--the Dnieper, Pripyat', and Teterev. Determination of sugars was conducted on filtered water by a spectrophotometrical method. The high content of reducing sugars in water of the Kiev reservoir is one of the main factors responsible for the intensive development of microorganisms, the intensification of biochemical processes, and the transformation of biogenic elements. This condition involves an increase in the number of planktonic organisms and the occurrence of 'blooming' of the water. The content of reducing sugars in water of the Kiev reservoir in 1965 and 1966 varied from 0.26-1.33 mg/liter, and in the rivers flowing into the reservoir this value was equivalent to 0.17-1.63 mg/liter. The glucose carbon was equivalent to 0.7-6.7% and 0.9-4.1% of the total organic carbon, respectively. The maximum quantity of sugars was found in spring and summer, and the minimum quantity was found in winter. The increase in content of reducing sugars in the water of the Kiev reservoir was one of the factors which caused 'blooming' of the water in the spring-autumn period of 1966. (Knapp-USGS)
W71-00221

MICROBIAL OXIDATION OF SOME PETROLEUM PRODUCTS IN WATERS OF THE DANUBE RIVER,
Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.
N. A. Gavrishova.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 3, 1969. Hydrobiological Journal, Vol 5, No 3, p 29-34, 1969. 6 p, 2 fig, 3 tab, 21 ref.

Descriptors: *Oily water, *Biodegradation, *Bacteria, Aquatic microorganisms, Oxidation, Rivers, Self-purification, Oxygen demand, Biochemical oxygen demand, Path of pollutants.
Identifiers: Danube River (USSR).

Bacteria capable of oxidizing machine oils are widely found in waters of the Soviet sector of the Danube. Their number decreases sharply only during the winter period, when there is no navigation and the water temperature is low. The number of bacteria-oxidizing petroleum products, and also their ratio to the number of heterotrophic bacteria, characterize the waters of the Danube as being contaminated to a considerable extent. Bacteria consumed up to 1-6 mg oxygen per liter of water during 5 days for the oxidation of petroleum products. (Knapp-USGS)
W71-00222

THE ROLE OF HIGHER WATER PLANTS IN THE SELF-PURIFICATION OF OIL-POLLUTED RIVERS,
Northern Research Inst. of Hydraulic Engineering and Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
N. V. Morozov, R. B. Petrova, and G. N. Petrov.
Translation of Gidrobiologicheskiy Zhurnal, Vol 5, No 4, 1969. Hydrobiological Journal, Vol 5, No 4, p 37-42, 1969. 6 p, 11 ref.

Descriptors: *Oily water, *Surface waters, *Aquatic plants, *Self-purification, Laboratory tests, Water pollution, Foreign projects.
Identifiers: Cattail, Common reed, Bulrush, Blunt-leaved pondweed, Canadian pondweed.

The role of higher water plants in the disposal of an oil film on water is demonstrated. The experiments were conducted in glass vessels having a capacity of 15-20 liters and were placed in the open air. The plants used were those most common in bodies of water in the Middle Volga region, USSR. The oil film was rapidly destroyed by the microorganisms in the presence of the plants and as this happened a small quantity of brown moss-like projections formed on the lower surface and were gradually destroyed, partly settling or disappearing. In the course of the experiment, which extended through the phases of bud formation, flowering, and fruiting, almost 90% of the surface of the water in the vessels with an oil concentration of 1 g/liter was cleaned of the film: by the 3rd - 5th day with greater reedmace, the 5th - 6th day with bulrush, the 5th - 7th day with blunt-leaved pondweed, the 4th - 8th day with reed, and the 5th - 9th day with lesser reedmace. In the control vessels without plants a similar phenomenon was noted on the 28th - 32nd day. The addition of petroleum has a positive effect on the development of plants which grow above and below the water and on Canadian pondweed. A concentration of 100 g/liter kills the plants in 3-10 days and a concentration of 10 g/liter kills them over a longer period. (Knapp-USGS)
W71-00223

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
Hugo B. Fischer.
University of California Water Resources Center contribution No. 132, March 1970. p 143, 16 fig, 9 tab, 21 ref. NSF Grant GK-3210.

Descriptors: *Pollutants, *Estuaries, *Computer programs, *Dispersion, Friction, Turbulence, Hydraulics, Mixing, Winds, Forecasting, Currents (Water), Water pollution sources, Water pollution control, *Model studies.
Identifiers: *Numerical models, Tidal velocities, Transport, Geometry two-dimensional.

A model for predicting pollutant distributions in estuaries is presented. The numerical model is entirely predictive, in-that it models both the hydraulics and pollutant transport without requiring field measurement of artificial coefficients. It can be used to study in advance of construction the effect of dredging, dike-building, or channel realignment, or the effect on an existing estuary of a new source of pollutant. An example of the use of the programs has been described. The importance of wind-induced circulation in the bay is shown by comparison of a run with wind and one without. Only the one-dimensional pollutant transport program has received field verification; the two-dimensional pollutant program has not been verified at all. (U-padhyaya-Vanderbilt)
W71-00231

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
D. W. Mackay, and J. I. Waddington.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 2, 1970. Preprint, Paper III-7, 6 p, 4 fig.

Descriptors: *Estuaries, *Dissolved oxygen, Salinity, Tides, Temperature, Biochemical oxygen demand, Sampling, *Dissolved oxygen, Water pollution sources, Water pollution control.
Identifiers: Retention time.

Some methods adopted by the Clyde River Purification to investigate the system are outlined, and one case for which it has been possible to look back on the accuracy of prediction is described. The main shipping channel of the Clyde Estuary receives the drainage from a heavily industrialized

region with population of 2.4 million. The circulation of water in the estuary is extremely complex. During dry spells, the dissolved oxygen content of the upper estuary falls to zero for a distance of up to 20 km. The dissolved oxygen levels in the Clyde Estuary vary directly with the fresh water input and inversely with the temperature. Equations were derived linking these parameters at each of 13 stations spaced at 3.2 km: intervals seawards from the head of the estuary. The salinity, for a range of five depths at each sampling station, has been measured. Flows are expressed as percentage exceedences. Retention time in the upper 32 km of the estuary varies between 2 and 20 days depending mainly upon fresh water input. The sum of the product of BOD and retention time gives an index of pollution producing the observed dissolved oxygen deficit. It was predicted that a reduction of 13% in the overall dissolved oxygen deficit would result from beginning operation of the new treatment plant. The reduction in the dissolved oxygen deficit is 11% overall and is in satisfactory agreement with the prediction made. (Upadhyaya-Vanderbilt)
W71-00236

THE STATUS OF THERMAL DISCHARGES ON THE PACIFIC COAST,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
For primary bibliographic entry see Field 05A.
W71-00242

THE STATUS OF THERMAL DISCHARGES EAST OF THE MISSISSIPPI RIVER,
Bronx Community Coll., N.Y. Nursing Center.
Emanuel V. Sorge.
Chesapeake Science, Vol 10, No 3 and 4, p 131-138, Sept-Dec 1969. 6 tab.

Descriptors: *Thermal pollution, *Powerplants, Efficiencies, Temperature ecosystems, Water pollution sources.
Identifiers: *Thermal discharge.

At present 86 fossil fueled plants are discharging their thermal effluents into the waters abounding the East Coast. By 1980 power needs will require 200 billion gallons of water per day or approximately one sixth of our annual nationwide run off and nearly 32% of all power stations will be adjacent to various estuaries. By the year 2000, utility companies will be utilizing almost twice the national freshwater runoff and a lifetime supply of either 10 million tons of uranium or 100,000 million tons of coal. Advanced nuclear reactors, highly more efficient, will be needed to ensure the safety of our waterways. Fossil-fueled plants are approximately 40 percent efficient whereas nuclear fueled plants tend to be less efficient, at 33 percent. A 1000 MW nuclear fueled plant will utilize nearly 1.3 billion gallons of water per day. Though one plant may raise the temperature only a few degrees within a limited area from the discharge canal, an accumulation of heated effluent from multiple units could prove disastrous for many miles, especially during critical periods of the year. Tables are given listing the nuclear plants in operation, plants for which equipment has been ordered and thermal plants in East Coast and Central U.S. (Upadhyaya-Vanderbilt)
W71-00255

GASES AND ODORS FROM STORED SWINE WASTES,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Arthur J. Muehling.
Journal of Animal Science, Vol 30, No 4, p 526-531, April 1970. 18 ref.

Descriptors: *Farm wastes, Ammonia, Manure, *Gases, Odor, Methane, Carbon dioxide, Hydrogen sulfide, *Hogs.
Identifiers: Swine confinement, *Manure odors, Storage pits.

One major problem arising from the storage, handling, treating and eventual utilization or disposal of hog wastes associated with confinement hog systems is the inevitable presence of gases and odors. The most important gases generated in a hog confinement unit are thought to be carbon dioxide, ammonia, hydrogen sulfide, methane and a large group of trace compounds such as amines, mercaptans, and skatoles. Under normal conditions in an adequately ventilated confinement unit no noxious gas reaches lethal or even harmful concentrations for pits or humans. Critically dangerous conditions exist when the oxygen content of the air diminishes from the normal 21 to 10% or less. It is only under special conditions such as during a ventilation failure, or during rigorous agitation of the manure pit that dangerous levels are reached. It may be possible to apply the industrial methods of treating odors; namely, dilution, absorption, adsorption, masking, counteraction and burning to the control or odors from stored manure. (Miner-Iowa State)
W71-00326

THE EFFECT OF HUMIDITY AND FLOORING TYPE ON THE MOISTURE CONTENT OF BROILER EXCREMENTS,
West Virginia Univ., Morgantown. Dept. of Animal Industries and Veterinary Science.
R. A. Peterson, M. A. Hellickson, W. D. Wagner, and A. D. Longhouse.
Poultry Science, Vol 49, No 2, p 439-443, March 1970. 1 fig, 2 tab, 2 ref.

Descriptors: *Farm wastes, Livestock, *Poultry, *Manure, Humidity, Air environment.
Identifiers: Broilers, Moisture content, *Flooring systems.

Experiments were conducted in part to determine the effect of humidity and flooring type on the moisture content of excreta from broilers. The experiments using broiler type chicks fed a high energy ration were conducted in four controlled 1.8 x 2.4 x 2.4 m environmental chambers. Relative humidity was measured and maintained. The following types were used, (1) 2.5 cm by 2.5 cm. welded wire (2) 1.3 cm. by 2.5 cm. welded wire and (3) 1.9 cm. flat wooden slats spaced 0.6 cm. apart. The average moisture content was significantly less in excreta collected under 1.9 cm. flat slats than collected beneath either 2.5 x 2.5 cm. or 1.3 x 2.5 welded wire floors. (Miner-Iowa State University)
W71-00327

EFFECT OF STRESS ON SWINE: HEAT AND COLD EXPOSURE AND STARVATION ON VANILMANDELIC ACID OUTPUT IN THE URINE,
Guelph Univ. (Ontario). Dept. of Nutrition.
M. P. Stefanovic, H. S. Bayley, and S. J. Slinger.
Journal of Animal Science, Vol 30, No 3, p 378-381, 1970. 1 fig, 2 tab, 12 ref.

Descriptors: *Hogs, Air temperature, *Urine, Amino acids, *Farm wastes.
Identifiers: Vanilmandelic acid output, Starvation, Metabolic response.

Tests were performed on 3 Yorkshire pigs in which they were subjected to normal conditions, extreme temperatures of 5 and 33C, and finally starved for 10 days at 20C. The urinary excretion of 3-methoxy - 4-hydroxymandelic acid (VMA) was measured when the pigs were housed in cages maintained at a room temperature of 20C. Observations of the VMA content was also made at times the pigs were under the stress conditions. The pigs increased in weight from 8 to 30 kg. during the 70 day experiment. Under normal temperature they excreted 10 mg of VMA per 24 hours. This increased to between 20 and 30 mg when the pigs were exposed to the low temperature. Exposure to the high temperature resulted in an excretion of 20 mg per day, but starvation caused a rapid decline to 3 mg per day. The excretion returned to normal values very rapidly when the animals were refed. These observations are discussed in relation to those made by other authors with other species on the effects of stress on the release and metabolism of catecholamines and their excretion in the urine, and it is suggested that the urinary output of VMA offers a convenient method of measuring physiological response to stress in the pigs. (White-Iowa State)
W71-00335

BACTERIAL CONTAMINATION IN POULTRY HOUSES AND ITS RELATIONSHIP TO EGG HATCHABILITY,
Pennsylvania Univ., University Park. Dept. of Poultry Science.
C. L. Quarles, R. F. Gentry, and G. O. Bressler.
Poultry Science, Vol 49, No 1, p 60-66, 1970. 8 tab, 15 ref.

Descriptors: *Farm wastes, *Bacteria, *Poultry, *Fertility, Eggs.
Identifiers: *Egg contamination, Egg hatchability, Air sampler, Litter houses, Litter nests, Wire floors, Roll-away nest.

This study was designed to determine if there was any relationship among poultry house contamination, egg contamination and hatchability. A high density sloping wire floor system was compared with the conventional litter floor system. Rates of egg production and fertility were similar in both systems. Litter houses averaged 9 times as many bacteria per cubic foot of air as wire floor houses. An attempt was made to study the level and transmission of coliform type bacteria as related to type of house and nest used. Hatchability of eggs in wire flood pens was superior to eggs from litter floor pens. Fungal contamination of air was approximately the same for both systems. (White-Iowa State)
W71-00337

PROBABLE SOURCES OF SALMONELLAE ON A POULTRY FARM,
Punjab Agricultural Univ., Hissar (India). Dept. of Veterinary Bacteriology and Hygiene.
S. M. Goyal, and I. P. Singh.
British Veterinary Journal, Vol 126, No 4, p 180-184, 1970. 2 tab, 17 ref.

Descriptors: *Farm wastes, *Salmonella, *Poultry, *Farm, Domestic animals, Rodents, Reptiles.
Identifiers: Salmonellosis, Transmission, Cross-infection.

This study was undertaken to determine various sources of Salmonellae on a poultry farm. Pigs, sheep, and other domestic animals were checked, as well as rats, sparrows, birds, and wall lizards. Eight Salmonellae types were isolated from poultry, pigs, rats, wall lizards, and house sparrows. S. anatum was isolated from all these sources and S. stanley from rats and poultry, indicating the possibility of cross-infection due to multiple foci of Salmonella infections. Rodents, free-flying birds and lizards were considered as important sources of Salmonellae. (White-Iowa State)
W71-00338

ATTRACTION OF COPROPHAGOUS BEETLES TO FECES OF VARIOUS ANIMALS,
Georgia Coastal Plain Experiment Station, Tifton.
G. Truman Fincher, T. Bonner Stewart, and Robert Davis.
The Journal of Parasitology, Vol 56, No 2, April 1970, p 378-383. 2 tab, 20 ref.

Descriptors: *Farm wastes, *Insects, *Habitats, Animal, Intermediate hosts.
Identifiers: *Beetle species, Pit traps, Feces, Woodland habitat, Swine pasture, Dairy pasture.

Beetles were attracted to pit traps baited with the feces of one of 12 different animals in 3 habitats. Comparison of the 3 habitats showed marked differences in beetle fauna. Most dung beetles were captured in traps baited with swine feces. Swine and opossum feces attracted 57.7% of all beetles

ptured and 74.8% of the Phanaeus species which e the major intermediate hosts of swine spirurids southern Georgia. Captured beetles comprised genera with more than 18 species. (White-Iowa ate)
71-00340

REAM SURVEYS PINPOINT POLLUTION,
nadian Industries Ltd., New Toronto (Ontario).
r primary bibliographic entry see Field 05A.
71-00348

OVEJOY V TOWN OF DARIEN (DESTRUC-ON OF COASTAL OYSTER BEDS BY MU-CIPAL CONSTRUCTION OF SEWAGE PELINES).
r primary bibliographic entry see Field 06E.
71-00351

IYSICAL DATA OF POTOMAC RIVER DAL SYSTEM INCLUDING MATHEMATI-AL MODEL SEGMENTATION,
deral Water Quality Administration, Annapolis, d. Chesapeake Technical Support Lab.
r primary bibliographic entry see Field 05G.
71-00375

UMIC SUBSTANCES: FULVIC ACID-DIAL-YL PHTHALATE COMPLEXES AND THEIR OLE IN POLLUTION,
epartment of Agriculture, Ottawa (Ontario). Soil search Inst.
nnar Ogner, and Morris Schnitzer.
ience, Vol 170, No 3955, p 317-318, October , 1970. 2 p, 17 ref.

escriptors: *Humic acids, *Soil physical proper-s, *Path of pollutants, *Fulvic acids, Soil con-mination, Toxins, Water chemistry, Pollutants, ater pollution sources, Aquatic environment, Or-nic compounds, Lakes.
entifiers: Dialkyl phthalate complexes.

he isolation and identification of small amounts of alkyl phthalates in fulvic acid is discussed and ggestions are made as to the possible role of ful-c acid in pollution. Fulvic acid is a water-soluble mic material with relatively low molecular eight that occurs widely in soils and waters. It can teract with lyophobic organic compounds such as kanes, fatty acids, and dialkyl phthalates, some of hich may be toxic pollutants. Fulvic acid may thus ediate the mobilization, transport, and immo-ization of such substances and contribute to the llution of the aquatic environment. (Lang-SGS)
71-00377

ULFUR: SIMULATED LONG-RANGE TRANS-ORT IN THE ATMOSPHERE,
ttelle Memorial Inst., Seattle, Wash.
oward Reiguam.
ience, Vol 170, No 3955, p 318-320, October , 1970. 3 p, 3 fig, 10 ref.

escriptors: *Model studies, *Air pollution, *Sul-r, Numerical analysis, Winds, Air environment, eather modification, Methodology.
entifiers: *Continental air pollution, Europe, At-ospheric transport, Particulates.

he question of whether or not air pollutants are nsported on a continental scale is examined by merical simulation. A simple atmospheric trans-rt and accumulation model, together with mean nd data and an estimated source distribution in estern Europe, were used. Results of the study ggest that Great Britain and Central Europe con-bute to observed concentrations of sulfur in orthern Europe. Pollutants are assumed to be ntained in the atmospheric belt within 3 km of rth surface. Mean winter concentration of total lfur in mg per cu m are plotted on three maps owing (1) sulfur emissions in all Western Eu-ropean countries, (2) all of Europe except the United Kingdom, and (3) sulfur emissions in only the United Kingdom. No natural sources are included nor are any sulfur removal mechanisms considered. The results suggest that in dry weather periods, when major removal devices are not in use, sulfur may be carried long distances. (Lang-USGS)
W71-00385

AIR POLLUTION SURVEILLANCE SYSTEMS,
National Air Pollution Control Administration, Cincinnati, Ohio. Bureau of Criteria and Standards.
George B. Morgan, Guntis Ozolins, and Elbert C. Tabor.
Science, Vol 170, No 3955, p 289-296, October 16, 1970. 8 p, 3 fig, 8 tab, 17 ref.

Descriptors: *Air pollution, *Aerosols, *Gases, *Surveys, *Instrumentation, Methodology, Remote sensing, Data collections, Atmosphere, Fallout, Air pollution effects, Pollutant identification, Urbanization, Rural areas.
Identifiers: *Particulates, *Surveillance systems.

Types of pollutants and their sources are summarized, current instrumentation and anticipated development of more specific and sensitive sensors are described, and the contrast between air quality in our urban environment and that of rural areas is discussed. Gaseous pollutants make up about 90% of the total mass emitted to the atmosphere with particulates and aerosols accounting for the remainder. Particularly important are small particulates in the respirable size range which may contain biologically active elements and compounds. These tend to remain in the air and interfere with both solar and terrestrial infrared radiation, which may affect global climate. Most devices and analyzers used for measuring air pollution are based on wet chemical methods. Extensive research is under way to develop remote sensing devices for use at ground level, in aircraft, and in earth satellites for area scanning and profiling. Concentrations of small particulates in rural areas of the country are increasing. Gaseous concentrations in larger cities show no trend, indicating downtown areas probably are source--saturated. (Lang-USGS)
W71-00394

POLLUTION OF LAKE ERIE, LAKE ONTARIO AND THE INTERNATIONAL SECTION OF THE ST. LAWRENCE RIVER.

International Lake Erie Water Pollution Board and International Lake Ontario-St. Lawrence River Water Pollution Board Report to International Joint Commission, 3 Vol, 1969. 796 p.

Descriptors: *Lake Erie, *Lake Ontario, *St. Lawrence River, *Water pollution, *Water pollution control, Surveys, Sampling, Legislation, Governments, International commissions, Great Lakes, Eutrophication, International waters.
Identifiers: International water pollution control boards.

Investigations were made to determine the extent and nature of pollution in the waters of Lake Erie, Lake Ontario and the international section of the St. Lawrence River. Data on which the report is based cover the period from 1963 through 1967, but further source information has been added in order to include significant observations. Lake Erie, Lake Ontario and the international section of the St. Lawrence River are being polluted on both sides of the boundary to an extent that is causing and is likely to cause injury to health and property on the other side of the boundary. There is substantial mixing of waters in the lakes to the extent that concentration levels of polluting materials are remarkably uniform throughout extensive areas of each lake. Thus, there appears to be no doubt that all major sources of pollution to the lakes have contributed directly, or indirectly, to their generally degraded condition. The major sources of pollution to the referenced waters are municipalities and industries. Municipal wastes comprise the principal source of phosphorus to the lower lakes. Municipal and industrial wastes also contribute dissolved and suspended solids, oxygen-consuming materials, toxic substances and pathogens. Remedial programs are suggested to be carried out promptly and on a continuing basis, to reverse the deteriorating conditions of the lakes. (Knapp-USGS)
W71-00397

TOWN OF DICKSON V STEPHENS (SPECIAL DAMAGE REQUIRED TO RECOVER FOR POLLUTION DAMAGE FROM MUNICIPALITY).
For primary bibliographic entry see Field 06E.
W71-00425

SMITH V BAY STATE DREDGING AND CONTRACTING CO (NEGLIGENT POLLUTION OF WATER BY DREDGING UNDER GARBAGE DISPOSAL WHARF).
For primary bibliographic entry see Field 06E.
W71-00515

KYSER V NEW YORK CENT RR (RIPARIAN RIGHT TO MAKE REASONABLE USE OF RIVER'S WATERS).
For primary bibliographic entry see Field 06E.
W71-00518

EWANSKI V SOLVAY PROCESS CO (LIABILITY FOR DEPOSITION OF INDUSTRIAL WASTE UPON LAND WHEN STREAM OVERFLOWS).
For primary bibliographic entry see Field 06E.
W71-00520

COOK V TOWN OF MEBANE (MUNICIPALITY'S LIABILITY FOR DIVERSION AND POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-00524

MOSES V TOWN OF MORGANTON (JOINT LIABILITY OF SEVERAL POLLUTERS).
For primary bibliographic entry see Field 06E.
W71-00525

ANDERSON V TOWN OF WAYNESVILLE (MUNICIPALITIES' LIABILITY FOR POLLUTION CAUSED BY SEWAGE DISCHARGE).
For primary bibliographic entry see Field 06E.
W71-00527

RHODES V INTERNATIONAL PAPER CO (LIABILITY FOR DAMAGES CAUSED FOR DISCHARGE OF INDUSTRIAL WASTES).
For primary bibliographic entry see Field 06E.
W71-00531

STANDARD OIL CO V GOODWIN (FOULING OF LANDS BY ESCAPE OF SEDIMENT FROM STORAGE TANKS).
For primary bibliographic entry see Field 06E.
W71-00537

NORTON COAL MIN CO V WILKEY (POLLUTION OF STREAM AND FARM BY COAL MINING WASTES).
For primary bibliographic entry see Field 06E.
W71-00541

5C. Effects of Pollution

EFFECTS OF ACID MINE WASTES ON PHYTOPLANKTON COMMUNITIES OF TWO NORTHERN ONTARIO LAKES,
Ontario Water Resources Commission, Toronto.

M. G. Johnson, M. F. P. Michalski, and A. E. Christie.
Journal Fisheries Research Board of Canada, Vol 27, No 3, p 425-444, 1970. 5 fig, 6 tab, 19 ref.

Descriptors: *Acid mine water, *Phytoplankton, *Lakes, Primary productivity, Waste treatment, Hydrogen ion concentration, Sulfates, Nitrates, Calcium, Carbon dioxide, Phosphorus, Silica, Chrysophyta, Cyanophyta, Lake Huron, Radioactivity, Radium radioisotopes, Physicochemical properties, Depth, Sampling, Bioassay, Ions, Carbon radioisotopes, Light penetration, Temperature, Diatoms, Ecosystems, Chlorophyceae, Water pollution effects, Water pollution sources.
Identifiers: *Ontario (Canada), *Uranium, Inorganic carbon, Dunlop Lake (Canada), Quirke Lake (Canada), Pecors Lake (Canada).

Differences between lakes contaminated by uranium-milling wastes and one unaffected lake were related directly to uranium extraction processes and subsequent waste treatment. Low pH and high concentrations of sulfates, nitrates, and calcium occurred in contaminated lakes; low concentrations of inorganic carbon, apparently limiting production, resulted from reduced solubility, loss, and possibly inefficient regeneration of carbon dioxide. Other major nutrients did not appear limiting, since there were more nitrates in contaminated lakes than in control lake; phosphorus and silica occurred in similar concentrations in all lakes. Lower phytoplankton populations and lower diversity indices were found in contaminated lakes; many species of Bacillariophyceae, Chrysophyceae, and Myxophyceae developed in unaffected lake but were absent or occurred rarly in contaminated lakes, with average primary productivities much lower. Bioassays confirmed the importance of inorganic carbon in limiting primary productivity. A potential compensatory mechanism in contaminated lakes was deepening of the euphotic zone. Although greater concentrations of inorganic carbon occurred and were assimilated in hypolimnetic than in epilimnetic waters, this did not overcome effects of reduction in species diversity and abundance of phytoplankton on areal primary productivity. (Jones-Wisconsin)
W71-00114

CONDENSED PHOSPHATES IN LAKE WATER AND WASTE WATER,
Toronto Univ. (Ontario). Dept. of Civil Engineering; and McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 02K.
W71-00116

BIOLOGICAL AND CHEMICAL INVESTIGATIONS ON THE EFFECT OF SEWAGE ON THE EUTROPHICATION OF BAVARIAN LAKES,
For primary bibliographic entry see Field 02H.
W71-00117

CONTRIBUTION OF RANGE LAND RUNOFF TO LAKE EUTROPHICATION,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 02H.
W71-00118

EUTROPHIC EVALUATION OF A SMALL MULTI-LAND USE WATERSHED,
Marquette Univ., Milwaukee, Wis. Dept. of Civil Engineering.
Alphonse E. Zanoni.
Available from NTIS as PB-194 755, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, June 30, 1970. 77 p. OWRR Project A-014-WIS (1).

Descriptors: Phosphorus compounds, *Eutrophication, Runoff, Fertilizer, Streams, *Watershed, Land-use, *Lake Michigan, Watershed management, Water pollution sources, *Phosphates, Farm wastes.
Identifiers: Menomonee River, Phosphorus loadings correlated to precipitation.

The Menomonee River watershed is a multi-land use watershed of 135 square miles area tributary to Lake Michigan. Approximately 370,000 people reside in the watershed which is 38% agricultural, 23% residential and the remainder divided among the other land use categories. Fifteen sampling sites were selected to evaluate the phosphorus loading from the watershed during various times of the year. During the two year investigation period, 30 sampling surveys were conducted and the samples were analyzed for total soluble phosphorus. A statistical investigation of the data showed that the phosphate concentration could not be correlated with precipitation amount, whereas, phosphorus pound loading could. The amount of phosphorus conveyed by runoff during precipitation periods varied considerably depending upon the amount of precipitation; varying from negligible amounts during low precipitation periods to high value of 83 pounds of phosphate per day per square mile during high precipitation periods. It was estimated that 1250 pounds per day of phosphate are discharged into Lake Michigan from the Menomonee River watershed, of which 40% is from treatment plant effluents.
W71-00141

EFFECTS OF A CONCENTRATED ACID ON WATER CHEMISTRY AND WATER USE IN A PLEISTOCENE OUTWASH AQUIFER,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 05B.
W71-00194

POTENTIAL THERMAL EFFECTS OF AN EXPANDING POWER INDUSTRY: OHIO RIVER BASIN I,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
D. E. Peterson, and R. T. Jaske.
AEC Research and Development Report, BNWL-1299, UC-70, February 1970. 63 p, 22 fig, 9 tab, 8 ref.

Descriptors: *Ohio River, *Thermal pollution, Cooling water, Thermal capacity, Evaporation, Conduction, Water pollution effects, Waste water treatment, Powerplants.
Identifiers: *ORSANCO, *COLHEAT, Topping ponds, Topping towers, Back-end loading, Advected energy, Projected conditions.

Simulations of 1964 average stream temperatures of the Ohio River System were performed using the COLHEAT computer code. Average monthly direct cooling capacities of the Ohio River and its major tributaries (excluding the Cumberland and Tennessee Rivers) within a 5 deg F envelope were calculated and found to range between 261,000 and 95,000 MW sub T. Projected stream-electric loads and cooling facility trends for the Ohio Basin indicate that direct cooling water requirements will equal low monthly average direct cooling capacity by the year 1990. Ancillary cooling facilities for low flow periods could extend the use of direct cooling for a major part of the cooling requirements through the turn of the century. (Osborne-Vanderbilt)
W71-00235

THERMAL ADDITION AND THE BENTHOS, CAPE COD CANAL,
Fish and Wildlife Service, Fort Hancock, N.J.
Jack B. Pearce.
Chesapeake Science, Vol 10, No 3 and 4, p 227-233, Sept-Dec 1969. 5 fig, 2 tab.

Descriptors: *Thermal pollution, *Temperature, *Benthos, Mussels, Ecology, Heated water, Water pollution effects.
Identifiers: Cape Cod Canal, Fin-fish.

Based on laboratory experimentation and field observations a study was conducted concerning the possible effects of thermal additions on the finfish and benthic mussel communities found in Cape Cod Canal. The results from a variety of laborator experiments suggest that temperatures of 25C ad versely affected most of the experimental organ isms. Fish moved from 15.5C to 31C died withi one hour. Mussels can tolerate alternate exposur to hot and cold over long periods. The larvae an plantigrade spat of mussels are far more tolerant c temperatures increase than adults. Changes in mus sel behavior were evident at temperatures we below those which are normally lethal. Thermal ad ditions affect the feeding rates of the dominan predators on Mytilus, thus possibly affecting com munity stability. Elevated temperatures were als found to affect finfishes which are normally as sociated with mussel communities. (Upadhyaya Vanderbilt)
W71-00245

THERMAL INFLUENCE ON INVERTEBRAT RESPIRATION,
Duke Univ., Beaufort, N.C. Marine Lab.
F. John Vernberg, and Winona B. Vernberg.
Chesapeake Science, Vol 10, No 3 and 4, p 234 240, Sept-Dec 1969. 8 fig, 1 tab.

Descriptors: *Temperature, *Invertebrate *Respiration, *Metabolism, Life cycles, Habitat Water pollution effects.
Identifiers: Cyclic changes, Body size.

Most invertebrates cannot maintain a body tem perature independent of their environment. How ever, various physiological and ecological strate gies have evolved that enable poikilotherms t metabolically compensate for thermal changes. T evaluate the probable metabolic success of an or ganism in a region of thermal additions, a numbe of factors need to be considered. These includ body size, stage in the life cycle of an organism cyclic changes, and the habitat of the anima Metabolic-temperature curves are somewha characteristic for species even though the shap and position of the curve may be changed by the mal acclimation. This is best demonstrated by stu dies involving adult trematodes. (Upadhyaya-Van derbilt)
W71-00246

TEMPERATURE AND ZOOPLANKTON,
Maryland Univ., Solomons. Natural Resources Ins
Donald R. Heinle.
Chesapeake Science, Vol 10, No 3 and 4, p 186 209, Sept-Dec 1969. 18 fig, 8 tab, 22 ref.

Descriptors: *Zooplankton, *Temperature *Metabolism, Thermal powerplants, Growth rate Predation, Water pollution effects.
Identifiers: *Thermal tolerance, Seasonal pattern.

All metabolic rates of zooplankton are dependen upon temperature. Siefken and Armitage have sug gested independence from temperature in som cases but with non-conclusive evidence. Rate generally rise in a linear fashion, with one or two in flection points when plotted on a semi-log scale and fall at higher temperatures. The upper limits o thermal tolerance for two species of copepods fro Chesapeake Bay were found to be near the norma temperature of the habitat during the summer. Ac climation temperature had little effect on the uppe limits of thermal tolerance. Estuarine copepod were killed by passage through the condensers of powerplant, although temperatures encountere were generally below the upper limits of therma tolerance. Chlorine gas was applied at relativel high rates at that particular powerplant and i suspected to be the cause of mortalities. The opera tion of the powerplant did not alter the seasona patterns of distribution or production of estuarin copepods. (Upadhyaya-Vanderbilt)
W71-00247

GREENING AND COPPER ACCUMULATIO IN THE AMERICAN OYSTER, CRASSOSTRE VIRGINICA, IN THE VICINITY OF A STEAM ELECTRIC GENERATING STATION,
Maryland Univ., Solomons. Natural Resources Ins

Villem H. Roosenburg.
Chesapeake Science, Vol 10, No 3 and 4, p 241-252, Sept-Dec 1969. 5 fig, 21 ref.

Descriptors: *Oysters, Aquatic environment, Temperature, Thermal powerplants, *Copper, Salinity, Water pollution effects.
Identifiers: Concentrations, *Greening, Condition index.

The effects of heated effluent on oysters in the Patuxent River were investigated. Oyster meats near the outfall of a steam electric generating station started to display green color shortly after initiation of plant operation. In time, the affliction increased in intensity and spread to oyster stations farther removed from the outfall. The greening of Patuxent oysters was probably caused by copper uptake, since green color and copper concentration (mg of copper per g dried meat weight) were closely correlated. Copper content of oysters decreased with distance from the outfall. There was an inverse relationship between oyster condition and copper concentration. This was most evident at stations near the outfall where oysters had high copper content. Amounts of copper per oyster, based on mg of copper per liter shell cavity volume, did not display great seasonal fluctuation. Oysters at special stations, established to investigate a possible copper source upstream from the plant, showed a reduction in mg of copper per g dried meat, while oysters at stations inside and near the outfall increased sharply in mg of copper per g dried meat. Indications in the Patuxent point to a relationship between oyster copper uptake and power plant operation. (Upadhyaya-Vanderbilt)
W71-00248

THE USE OF CHLORINE IN THE COOLING WATER SYSTEM OF COASTAL POWER STATION,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
J. S. A. Beauchamp.
Chesapeake Science, Vol 10, No 3 and 4, p 280, Sept-Dec 1969.

Descriptors: *Cooling water, *Chlorine, *Mussels, Water pollution effects, Powerplants.
Identifiers: Coastal stations, Bacterial slime, Growth.

In the intake conduits of coastal power stations marine fouling may build up to a remarkable extent. In two extreme cases the amount of marine fouling, consisting of barnacles, tube worms, mussels and debris, has exceeded 300 tons. The greatest hazard to station operation arises from the growth of mussels as these grow to a size that they can, when detached, block or partially block condenser tubes. The schedule now being used is to inject chlorine continuously at a rate of 0.5 ppm. It seems that combined chlorine or combined bromine, probably in the form of bromamines, is extremely distasteful to mussels. Bacterial slime that forms in the condensers can be controlled by injecting chlorine at 2-3 ppm for 15 minutes every 4 hours. The adoption of a schedule of low level chlorination for the control of marine fouling has made it possible to carry out trials on the farming of sea fishes using the warm water discharged from power stations. (Upadhyaya-Vanderbilt)
W71-00249

ALLOWABLE THERMAL POLLUTION LIMITS AS A PHYSICOCHEMICAL APPROACH,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
Walter Drost-Hansen.
Chesapeake Science, Vol 10, No 3 and 4, p 281-288, Sept-Dec 1969. 22 fig, 33 ref.

Descriptors: *Thermal pollution, *Temperature, Membranes, Viscosity, Respiration, Water pollution effects, *Physicochemical properties.
Identifiers: Conductance, Biochemical reaction, Optical density.

The existence of abrupt changes, at certain discrete temperatures, in biochemical reaction rates and in the behavior of biological systems, has been known for years. In systems where no active transport is expected, anomalies are often observed in the vicinity of 15, 30, and 45C. It appears, in general, that water near interfaces, regardless of solute present, is capable of undergoing abrupt changes, probably reflecting higher order phase transition. An upper thermal limit for the survival of many organisms is found to be at 30-33C. Multiple temperature optima in an organism may be the result of the utilization temperature intervals. A very intense, concerted study of the simultaneous influences of various parameters, including temperature, at closely-spaced values of the parameters, is needed. (Upadhyaya-Vanderbilt)
W71-00250

DETERMINATION OF UPPER TEMPERATURE TOLERANCE TRIANGLES FOR AQUATIC ORGANISMS,
Maryland Univ., Solomons. Natural Resources Inst.
Andrew J. McErlean, Joseph A. Mihursky, and Howard J. Brinkley.
Chesapeake Science, Vol 10, No 3 and 4, p 293-296, Sept-Dec 1969. 3 fig, 8 ref.

Descriptors: *Aquatic environment, Fish, *Temperature, Resistance, Thermal pollution, Water pollution effects.
Identifiers: *Tolerance polygon, Linearity, Aquatic organism, Rank correlation, Acclimations.

Temperature tolerance polygons are constructed by plotting lethal temperatures (LD50) for different acclimations against the temperature of acclimation, Ta. Area of the polygons give thermal tolerances. The effect of plotting (LD50-Ta) against Ta is to linearize the LD50 points. To examine this linearity, the difference (LD50-Ta) was determined for a variety of fish species and plotted against Ta. In most cases a line may be fit to the data points by eye since the data points are virtually colinear. The calculated upper tolerances for these 18 species were compared to those given in Brett by rank correlation. A rank correlation of 0.95 was obtained although some rank inversions occurred. The advantage of the method is that the area defined by the triangle may be easily measured and upper temperature tolerance may be expressed as a single numerical value. Relatively few LD50 determinations, perhaps as few as four, are required to obtain an estimate of upper tolerance. A possible limitation of the technique is that it may overestimate upper tolerance for temperature - intolerant organisms at higher acclimations. (Upadhyaya-Vanderbilt)
W71-00251

THE DIURNAL CURVE IN ESTIMATES OF PRIMARY PRODUCTIVITY,
Federal Water Pollution Control Administration, Alameda, Calif. Southwest Region.
For primary bibliographic entry see Field 05A.
W71-00252

DESTRUCTION OF PHYTOPLANKTON IN THE COOLING WATER SUPPLY OF A STEAM ELECTRIC STATION,
Maryland Univ., College Park. Dept. of Zoology.
Raymond P. Morgan, II, and Raymond G. Stross.
Chesapeake Science, Vol 10, No 3 and 4, p 165-171, Sept-Dec 1969. 3 fig.

Descriptors: *Thermal pollution, *Phytoplankton, *Photosynthesis, Temperature, Time, Primary productivity, Water pollution effects.
Identifiers: Cooling water supply, Steam electric station, Carbon uptake, Thermal inhibition.

Rates of photosynthesis were used to evaluate the response of phytoplankton when passed through the cooling system of a power generating facility. Photosynthesis was measured as the uptake of carbon. A factorial design permitted evaluation of heat input, total effect of passage, and degree of recovery. Six experiments measured response at a fixed time of day and at various times in a daily cycle. An increase in temperature of approximately 8.0C stimulated photosynthesis when natural water temperatures were 16C or cooler and inhibited photosynthesis when natural water temperatures were 20C or warmer. Passage through the cooling system resulted in further inhibition when the water was warm and nullified thermal stimulation when the water was cool. No recovery was observed within a four hour period following passage. Photosynthesis in cooled effluent water was either unaffected or actually suppressed. The existence of daily synchrony in the algae was shown by a daily maximum of thermal stimulation at 0900. The rhythm is considered inherent and only amplified by warming. (Upadhyaya-Vanderbilt)
W71-00253

TEMPERATURE AND ROOTED AQUATIC PLANTS,
American Univ., Washington, D.C. Dept. of Biology.
Richard R. Anderson.
Chesapeake Science, Vol 10, No 3 and 4, p 157-164, Sept-Dec 1969. 4 fig, 2 tab.

Descriptors: *Temperature, *Rooted aquatic plants, Respiration, Statistical methods, *Heated water, Water pollution effects.
Identifiers: Oxygen consumption, Leaf size, Ruppia maritima, Potamogeton perfoliatus.

In relation to the disappearance of a Ruppia maritima population near the effluent of an electrical generating station on the Patuxent River, Maryland, temperature effects on respiration and photosynthesis of aquatic plants was studied. A Gilson differential respirometer was used to investigate respiratory variation in leaves of Potamogeton perfoliatus at 25, 30, 35, 40, and 45C. This species grows with Ruppia maritima, appears to be more tolerant of high temperatures, and plant material was readily available. Plants growing in heated and non-heated water were compared. The data indicate that Potamogeton perfoliatus is capable of physiological adjustment to higher temperatures as the leaf matures, since only older leaves tended to respire less at the elevated temperatures. Death of plant material occurred at 45C. (Upadhyaya-Vanderbilt)
W71-00254

THE STATUS OF THERMAL DISCHARGES EAST OF THE MISSISSIPPI RIVER,
Bronx Community Coll., N.Y. Nursing Center.
For primary bibliographic entry see Field 05B.
W71-00255

SOME ECOLOGICAL RELATIONSHIPS OF THE ORGANIC DRIFT IN PRATER'S CREEK, PICKENS COUNTY, SOUTH CAROLINA,
Clemson Univ., S.C. Dept. of Entomology and Zoology.
William Kenneth Reisen.
Unpublished Masters Thesis, Clemson University, Clemson, South Carolina. December 1968. 127 p, 13 tab, 35 fig, 75 ref. OWRR Research Report A-013-SC (5).

Descriptors: *Organic drift, *South Carolina, *Ecological Relationships, Regression analysis, Qualitative, Quantitative, Fluctuations, Density dependency, Carrying capacity, Productivity, Seasonal, *Benthic fauna, Abundance, Feeding activity, Spawning, Plumpness, Temperature, Oxygen concentration.
Identifiers: *Reptilia, *Amphibia, *Osteichthyes, Cyprinoiformes, Perciformes, *Insecta, *Crustacea, *Bottom communities, Literature review, Condition factor.

An ecological study was conducted in Prater's Creek, Pickens County, South Carolina to observe the qualitative and quantitative fluctuations of the

organic drift through time, both diurnally and monthly. The relationships of organic drift with benthic density and emergence were investigated. The density dependency of the drift was tested to ascertain its relationship with carrying capacity and productivity. The dependency of the fish community on drift as a food source was also investigated. It was concluded that drift fluctuates both qualitatively and quantitatively through time as a function of light, time of day with density and seasonally. The relationship between drift and benthic density and relative abundance was found to be both density dependent and density independent depending upon the taxa considered. Consequently, the overall productivity of a given stream segment could not be estimated on the basis of drift. Fish were found to depend only slightly on drift for food. This was a function of both habitus and habitat. Feeding activity, condition factor and spawning of the fish were all found to be synchronized with fluctuations in the total drifting biomass. (ahtola-Washington)
W71-00303

EFFECTS OF SAN DIEGO'S WASTE WATER DISCHARGE ON THE OCEAN ENVIRONMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
Carl W. Chen.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 1, p 1458-1467, August 1970. 10 p, 3 fig, 7 tab, 3 ref.

Descriptors: *Outlets, *Sewage disposal, *California, *Water pollution effects, *Aquatic life, Aquatic habitats, Aquatic environment, Sea water, Water quality, Water pollution sources.
Identifiers: Marine outfalls, San Diego (Calif).

Studies of the ocean environment near the city of San Diego waste water outfall include variance and time series analyses to discern physical, chemical, and biological changes and population trend and composition of biota. The outfall performed effectively in diffusing wastes to the environment. The environment was gradually reaching an equilibrium state. The marine ecosystem was relatively stable in both planktonic and benthic composition. The benthic populations were stimulated by the waste discharge and the deposit of organic matter. (Knapp-USGS)
W71-00347

EFFECTS OF ACID MINE DRAINAGE ON WATER QUALITY OF A RESERVOIR,
Pennsylvania Dept. of Health, Harrisburg. Div. of Water Quality; Missouri Univ., Columbia. Dept. of Zoology; and Missouri Dept. of Conservation, Columbia. Div. of Fisheries.
Edward R. Brezina, Robert S. Campbell, and James R. Whitley.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part 1, p 1429-1436, August 1970. 8 p, 4 fig, 4 tab, 19 ref. OWRR Project B-001-MO.

Descriptors: *Acid mine water, *Water pollution effects, *Reservoirs, *Missouri, Sulfates, Acids, Mine drainage, Water quality, Alkalinity, Monitoring, Water pollution sources, Water chemistry.
Identifiers: Montrose Reservoir (Mo).

To determine whether acidic water draining from strip mines altered the water quality of Montrose Reservoir and tributary Deepwater Creek in Missouri, water samples were analyzed for pH, potential free acidity, specific conductance, bicarbonate alkalinity, and sulfate ion concentration. Acid inflow resulted in a slight increase in specific conductance, a slight decrease in bicarbonate alkalinity, and a slight increase in sulfate ion concentration in Montrose Reservoir. The relationship of time of acid inflow to rainfall was established by hourly monitoring of water quality in Deepwater Creek before, during, and after heavy rainfall. Changes in water quality were minimal except immediately after precipitation began. (Knapp-USGS)
W71-00372

THE INFLUENCE OF FLOW ON THE SPAWNING OF BROOK TROUT IN THE LABORATORY,
National Water Quality Lab., Duluth, Minn.
John G. Hale, and Donald A. Hilden.
Transactions of the American Fisheries Society, Vol 99, No 3, p 595-597, July 1970. 1 tab, 4 ref. FWQA Project ETK 18050---9/70.

Descriptors: *Spawning, *Life History Studies, *Bioassay methods, Water pollution effects.
Identifiers: Flowing-water system, Substrate.

Information was needed on the spawning success of adult brook trout maintained on a diet of commercial trout pellets in the laboratory under controlled light through one complete reproductive cycle. It was also planned to determine whether or not brook trout would spawn in the test tanks where the flow was periodic and compare the results with spawning in coninuous flow at a constant delivery rate. Gravel, 1/4 to 1 inch in diameter and glass marbles 1/2, 9/16, and 7/8 inch in diameter were tried as spawning substrate. Marbles were tried because glass does not react with most toxicants; whereas, it is possible that gravel might react with some toxicants to alter the concentration in a long-term study. Spawning was not considered successful with marbles since no eggs were buried. The female in the tank containing marbles was spent indicating that she had spawned but her eggs were exposed, and probably onsumed by fish in the tank. Spawning took place in tanks with a constant flow, as well as in tanks with periodic flow. The rate did not appear to influence spawning success, since it was accomplished at 1/2, 1, and 2 liters a minute. (Hale-FWQA)
W71-00407

THE IRRELATION OF CARBON AND PHOSPHORUS IN REGULATING HETEROTROPHIC AND AUTOTROPHIC POPULATIONS IN AQUATIC ECOSYSTEMS,
Federal Water Quality Administration, Athens, Ga. National Pollutants Fate Research Program.
Pat C. Kerr, Doris F. Paris, and D. L. Brockway.
Available from NTIS as PB-195 195, $0.95 in microfiche. Also for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.60, I67.13/4:16050 FGS 07/70. Water Pollution Control Research Series 16050 FGS 07/70, (July 1970). 53 p, 4 tab, 17 fig, 51 ref. FWQA Project 16050 FGS.

Descriptors: Cycling nutrients, *Carbon, *Phosphorus, *Cyanophyta, Aquatic environment, Carbon dioxide, Ecosystems, South Carolina, Algae, Trophic level.
Identifiers: *Antotrophic populations, *Heterotrophic populations, Lake Hartwell (South Carolina), Anacystis nidulans, Aquatic ecosystems, Algae growth, Algal populations.

Laboratory and field investigations were conducted on the fate and cycling of carbon and phosphorus in selected aquatic ecosystems. Inorganic carbon, as CO2, supplied by both bacterial cultures and cylinder gases, stimulated the growth of the blue-green alga Anacystis nidulans. The carbon requirement (10-5 ug CO2 per cell) for this alga was determined for a single set of experimental conditions. The addition of CO2 to natural water low in phosphorus (5 ug P) and nitrogen (5 ug N) in the laboratory stimulated the growth of indigenous algal populations. The limiting and luxury cellular concentrations of phosphorus for starved Anacystis nidulans were found to be 0.3 x 10-8 ug P and 3.0 x 10-8 ug P per cell, respectively. Diel studies of a stream which received biologically-treated sewage demonstrated that the dissolved CO2 and HCO3 continually produced in the system were essentially depleted by the autotrophic organisms during daylight hours, while the concentration of phosphorus (1.3-2.2 mg/l P) remained unchanged. Addition of organic carbon and inorganic nitrogen and phosphorus along and in combination to the waters studied directly stimulated the oxidative metabolism of the heterotrophic population, which resulted in increased dissolved CO2 and HCO3-. This increased availability of inorganic carbon, rather than the direct metabolic removal of dissolved phosphorus by the algae, appeared to be directly responsible for the growth of the algal populations in the waters studied.
W71-00475

GREEN V PELICAN NATURAL GAS CO (DAMAGES FROM OIL WASTES).
For primary bibliographic entry see Field 06E.
W71-00530

NAUVOO BLACK CREEK COAL CO V JOHNSON (LIABILITY FOR SUBSTANTIAL INJURY CAUSED BY STREAM POLLUTION).

160 So 242-244 (Ala 1935).

Descriptors: *Alabama, *Cultivated lands, *Damages, *Water pollution, Pollutants, Watercourses (Legal), Pollutant identification, Overflow, Riparian land, Riparian waters, Riparian rights, Relative rights, Mining, Mine wastes, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff landowner sought damages for alleged permanent injury to his property, agricultural lands, which he alleged was caused by defendant's pollution of a stream running therethrough. From a judgement for plaintiff, defendant appealed based on the trial court's charge to the jury. The court held to be adequate a charge to the jury that while defendant had the right to use the stream above plaintiff's land for mining purposes, he did not have the right to place in said stream or tributaries thereof any substance that would be deposited on plaintiff's land that would cause injury or deterioration thereto. The omission of the words 'substantial' or 'material' from said charge did not mislead the jury in light of the court's oral charge that plaintiff could recover only for substantial injury. The judgment for plaintiff was affirmed. (Price-Florida)
W71-00536

5D. Waste Treatment Processes

WASTE WATER TREATMENT FOR RETURN TO NATURAL CYCLE REUSE,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
F. M. Middleton.
Water and Wastes Engineering, Vol 5, p 61-64, 1968. 1 fig, 2 tab, 12 ref.

Descriptors: *Waste treatment, *Waste water disposal, *Water reuse, Water purification, Oxygen demand, Solid wastes, Bacteria, Nutrients, Waste water treatment, Anaerobic digestion, Phosphorus, Nitrogen, Thermal pollution, Dissolved solids, Odor, Disinfection, Economics, Water quality.
Identifiers: Nutrient removal, Water quality criteria.

Changes of concepts and treatment processes to adequately control natural recycle and reuse of waste water effluents are discussed. Treatment can be improved by better operation of existing plants: controlling organic and hydraulic overloads, operation of facilities and adequate testing to permit optimum operation. New plants should be designed to eliminate digesters since large amounts of biochemical oxygen demand, nitrogen, and phosphate in supernatants or elutriates are returned to the process only to cycle again and discharge into the effluent. For new processes consideration should be given whether new problems are created. Better removal of oxygen-demanding materials is required, as well as a large percentage of carbon and nitrogen in wastes. Present technology can reduce phosphorus by 80% without large capital expenditures. The diversity of waste treatment systems allow their application to local situations. Nitrogen removal is feasible by ammonia stripping and biological nitrification-denitrifica-

ion; other techniques lack adequate full-scale testing. More effort must be directed to eliminate dissolved solids, heat, and odor-potential of discharged wastes. Disinfection is more effective and economical when the effluent is free of solids, organics, and ammonia. (Haskins-Wisconsin)
W71-00107

INORGANIC CHEMICAL INDUSTRY: CLEAN WATER COST ESTIMATE.

Environmental Science and Technology, Vol 14, No 6, p 469-470, June 1970. 1 fig.

Descriptors: *Costs, *Chemicals, *Inorganic compound, *Waste water treatment, Industrial wastes.

Economics of clean water' the third annual report o Congress on the cost of clean water for the United States contains waste water treatment profiles for municipalities animal feed lot wastes, and inorganic chemicals industry. This report details the in-depth cost estimates achieving certain levels of waste water treatment within these particularly troubled areas. During the 5 year period from 1970 to 1974 the inorganic chemicals industry will have to increase outlays nearly 8 fold to each the 100% level of treatment. To keep its present level of treatment the industry must increase present outlays for capital and operating expenses more than 50% from 414.5 million in 1970 o 630.2 million in 1974. The main problem with he treatment of industry's wastes is the solids, both dissolved and suspended. In general biological methods of treatment are not applicable for physical treatment of equalization, neutralization, flocculation, sedimentation, and sludge dewatering are employed. The cost estimates for treatment were developed for 4 levels of flow rates, 3 levels of acidity, 2 levels of suspended solids and 3 levels of otal dissolved solids. However, the data from the 59 plants, representative of the 2,700 plants in the United States, were not sufficiently complete with regard to effluent quality to construct a statically significant relationship between the numbers of plant and the effluent quality parameter such as acidity, suspended solids, and dissolved solids. (Hancuff-Texas)
W71-00119

ACTIVATED SLUDGE (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
H. S. Azad, D. E. Bergmann, and M. R. Stumpf.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 897-910, June 1970. 105 ref.

Descriptors: *Activated sludge, *Waste water treatment, Sewage treatment, Biological treatment, Mathematical models, Aerobic treatment, Industrial wastes, Performance, Evaluation, Oxygenation, Temperature, Mixing, Nutrients, Costs, Microbiology, Toxicity, Economics.
Identifiers: Growth, Settling.

The 1969 literature on the activated sludge process s reviewed. A variety of process modifications is discussed, and include: rotating disc biological contactor and wasting activated sludge solids to the preaeration tank ahead of the primary settling tank. Industrial applications include: distillary wastes, slaughter house wastes, starch wastes, aliphatic compounds, vegetable tanning liquors, chrome tanning wastes, dye wastes, phenolic wastes, petrochemical wastes, and organophosphorus pesticides. The cost of a centrally combined industrial waste water treatment complex treating wastes from separate industries is presented. Evaluation of a thermophilic activated sludge system is presented and the influence of temperature on settling developed. The influences of oxygen transfer efficiency are described and a variety of aeration systems discussed. The influence of nutrients, namely, nitrogen and phosphorus are presented from the standpoint of kinetics as well as removal efficiencies. The inhibitory or toxic effects of various compounds on activated sludge process are discussed. Boron, cyanide and various metals are cited as examples. A variety of studies on the design and operation of settling, dewatering and thickening are described. (Hancuff-Texas)
W71-00120

STEEL INDUSTRY WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
S. E. Smith.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1198-1205, June 1970. 63 ref.

Descriptors: *Steel, *Industrial wastes, *Waste water treatment, Iron, Chemicals, Ion exchange, Electrodialysis, Oxidation, Neutralization.
Identifiers: *Pickling.

Recent literature pertaining to the steel industry wastes is reviewed. A large portion of the literature has been dedicated to ways of using the waste water as a product or ways of using one waste water to treat another. A great deal of attention was also devoted to the recycling of components of the waste water within the plant. A discussion is presented on several pilot plant studies made for the control of pollution from steel manufacturing in particular hot rolling. A very large number of studies were made on the treatment of pickling waste water. Several of these concentrated on merely meeting water quality requirements while others concentrated on recapture and reuse of the waste materials. The most commonly recovered items were gypsum and magnetic iron oxides. The processes such as chemical precipitation, ion exchange, electrodialysis, neutralization and oxidation are reported for the treatment of pickling wastes. The need for an iron containing fertilizers in arid regions and a non-sodium substitute for the sodium chloride regenerant in water softening are discussed in the light of using ferric chloride as a substitute. Ferric chloride is also recovered from pickle liquors. Deep-well injection of spent pickle liquors received some attention and the construction and operation of disposal is described. (Hancuff-Texas)
W71-00121

AGRICULTURAL (LIVESTOCK) WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
J. R. Miner.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1171-1179, June 1970. 59 ref.

Descriptors: *Agriculture, *Industrial wastes, *Waste water treatment, Odors, Cattle, Crops, Biological treatment, Dairy industry, Poultry.
Identifiers: Manure, Feed lots.

Recent literature concerning agricultural waste disposal is reviewed. The problems associated with water pollution control related to cattle feed lot runoff were discussed in relation to the characteristics, handling, treatment, utilization, disposal and odor problems of livestock manure. A review of research pertaining to swine waste management includes discussions of manure properties, application to cropland, treatment technology, alternatives for disposal or utilization, and gases and odors related to manure storage. The production, value, use, and disposal of poultry manure is also included. The value of poultry manure as a fertilizer for specific crops is discussed. A great deal of study has been made on the gases and odors evolved from manure decomposition and a court case is sited in which an award of $36,000 was made due to water pollution and odors. Some wastes which are characterized are from steer, sheep, poultry, and storm runoff from a variety of cropland. A great deal of study was done on cattle feed lot wastes and various methods of treatment. The application of partly treated livestock wastes to cropland has been of growing interest. The largest problem occurring with this type of disposal is the contamination of the groundwater by nitrogen mostly in the form of nitrates. A variety of biological treatment processes were studied including lagoon, aerated lagoons, extended aeration, anaerobic digestion, and aerobic digestion. (Hancuff-Texas)
W71-00122

PLATING AND CYANIDE WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
W. N. Grune.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1211-1230, June 1970. 97 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Metals, Water pollution control, Ion exchange, Chromates.
Identifiers: *Plating, *Cyanide, Recovery, Reuse.

In recent years, the use of electrochemistry to help clean up various industrial wastes, including those from steel pickling plants and plating operations, has steadily increased. The most important objectives of waste treatment of these industries is the removal or reduction of toxic materials. A great deal of interest was shown in the development of waste treatment plant automation and continuous analysis of effluent quality. A large number of examples of controls are presented. The possibility of treating cyanide wastes through biological treatment was shown by several investigators. Designs and operating characteristics of ion exchange units used for removal of plating wastes are discussed. A review of the various methods for cyanide control including (1) dilution, (2) alkaline chlorination, (3) electrolytic oxidation, (4) vacuum evaporation, and (5) ion exchange is presented. Commercially available equipment and processes also are reviewed. Potential recovery and reuse of cyanides and chromates is given some consideration and methods are described. The potential water pollution problem evolving from disposal of cyanides in water and streams is summarized. (Hancuff-Texas)
W71-00123

TANNERY WASTES (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
J. D. Eye.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1188-1189, June 1970. 13 ref.

Descriptors: *Industrial wastes, *Waste water treatment, Biological treatment, Activated sludge, Chromium, Sulfides.
Identifiers: *Tannery wastes, *Leather.

Recent literature on tannery wastes and tannery waste treatment is reviewed. The effect of trivalent chromium derived from tannery wastes on biological treatment processes was found to have little effect even at high initial concentrations because of the precipitation of chromium hydroxide on mixing with high alkaline wastes. Several biological pilot scale studies are reported. In one anaerobic-aerobic pilot unit the spent vegetable canning solutions derived from a sole leather tannery was treated to about 85% efficiency for the removal of BOD and suspended solids. A completely mixed activated sludge system on a pilot scale was studied for treating wastes from 5 other tanneries. BOD removals of 90% were observed. Chromium did not effect the process adversely. A pilot plant study of the treatment of the combined wastes from 19 tanneries, 8 other industries and 2 municipalities is discussed. A small scale two stage activated sludge system was utilized for studying tannery waste treatment and it was found that sulfides as high as 300 mg/l were not detrimental to the treatment. (Hancuff-Texas)
W71-00124

HIGH-RATE, FINE-MESH SCREENING OF COMBINED WASTE WATER OVERFLOWS,
Cornell, Howland, Hayes, and Merryfield, Corvallis, Oreg.

Donald M. Marske.
Journal of the Water Pollution Control Federation, Vol 42, No 8, p 1476-1494, August 1970. 13 fig, 6 tab, 3 ref.

Descriptors: *Screens, *Waste water treatment, *Sewage treatment, Pilot plants, Storm runoff, Costs, Efficiencies.
Identifiers: *Combined sewage.

Most combined sewers do not have a capacity during heavy storm periods to transport all of the waste and storm water to a treatment facility. This paper reports on (1) the character of the combined waste water overflows, (2) the treatment capability of high-rate, fine-mesh, screens, and (3) comparison of high-rate, fine-mesh, screening to other methods of treating combined waste water overflows. The screen unit produced the best results when operated at an influent flow rate of 1,700 gpm (130 gpm/sq ft) with a 165 mesh stainless steel collar screen rotating at a speed of 60 rpm. The screen unit is capable of treating comparable to a primary clarifier. The screened effluent flow is typically 90% of the influent. The screening unit is an economically feasible method of treating combined waste water overflows. Factors to be considered in the selection of screening are discussed. The estimated construction costs for a 25 mgd screening facility is $496,000. The estimated annual maintainance cost is $18,500. The cost of treatment is estimated at $0.22/1000 gal. (Hancuff-Texas)
W71-00127

A POLLUTION ABATEMENT PROGRAM FOR DISTILLERY WASTES,
American Distilling Co., Pekin, Ill.
R. G. Paulette, C. S. Boruff, and J. O. Nack.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1387-1394, July 1970. 6 fig, 2 tab.

Descriptors: *Industrail wastes, *Pollution abatement, *Waste water treatment, *Activated sludge, Sewers, Sewage treatment, Design flow, Aerobic treatment, Nutrients.
Identifiers: *Distillery wastes.

A program of pollution abatement at a distillery is presented. The facility has a capacity for 12,500 bushels of grain per day and operates at 8,500 bushels per day. In the first stage of the pollution abatement program 27 sewers were identified, flows were monitored, and water samples were collected and tested. Sewerage improvements were recommended to separate the process and sanitary wastes. Contaminated water was redirected to seven sewers, to an interceptor sewer and the main row waste pumping station. The treatment efficiency of an activated sludge process was tested against nutrient concentration, mixed liquor suspended solids, unit weight of sludge produced per unit weight of BOD, pH, and temperature. A nutrient supplement would be required to treat the wastes through the aerobic process. An extended aeration plant was recommended in the preliminary report for a number of reasons: (1) It retains a large mass of active organisms to survive long weekend shutdowns, (2) It has the ability to dissipate extremes of pH, temperature and high organic loading, (3) It provides a cooling effect during treatment by the aeration process, (4) It offers greatest economy of installation and operating costs. Based on a 52-hour detention time at average flow, a biological loading of 20 lbs of BOD per thousand cubic feet is provided. Information presented is to provide some of the basic design criteria for other distillery waste plants. (Hancuff-Texas)
W71-00128

PERFORMANCE OF THE SOMERSET, OHIO, OXIDATION DITCH,
Ohio Univ., Athens.
Harry M. Kaneshige.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1370-1378, July 1970. 8 fig, 4 tab, 2 ref.

Descriptors: *Performance, Sewage treatment, Lagoons, Waste water treatment, Efficiencies, Ponds, Organic loading, Sludge, Costs, Drying, Activated sludge, Operations, Ohio.
Identifiers: *Oxidation ditch, Suspended solids, Expenses, Somerset (Ohio).

A three year study of the operation of a mechanically aerated oxidation ditch with final settling and sludge return was conducted at Somerset, Ohio. The plant serving about 1,500 people and treating predominantly domestic waste achieved excellent overall removal of suspended solids and BOD. Power consumption was about 1 kwh/cu m or 4 to 5 kwh/kg BOD removed. Power costs were about $20/1000 cu m of flow compared with about $28/1000 cu m for extended aeration plants. Surges and mechanical problems caused reduction in effluent quality but the plant recovered quickly. Extremely cold weather also caused poor performance. Extensive velocity distributions studies were made and several figures are presented illustrating the results. Monthly averages for BOD ranged from 150 to 300 mg/l averaging between 225 and 275 mg/l. Final effluent BOD ranged from 4 to 196 mg/l averaged around 8 to 10 mg/l. (Hancuff-Texas)
W71-00130

IDENTIFICATION AND SURFACTANT DEGRADING ABILITY OF BACTERIA 'STANDARD' SHAKE FLASK INOCULUM,
Army Natick Labs., Mass.
Morris R. Rogers, and Arthur M. Kaplan.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part I, p R263-R269, August 1970. 1 tab, 20 ref.

Descriptors: *Microorganisms, *Surfactants, *Bacteria, *Degradation (Decomposition), Laboratory tests, Detergents, Cultures, Standards, Activated sludge, Waste treatment, Linear alkylate sulfonates, Detergents, Waste water treatment.
Identifiers: *Identification, Media.

The shake culture presumptive test for measuring the biodegradability of linear alkylate sulfonate (LAS or soft anionic surfactant) used a mixed inoculum originially obtained from an activated sludge waste treatment system. Twenty species of bacteria were isolated from the culture using streak plates of (BBL) nutrient agar, endoagar and tryptone glucose extract agar. The results revealed that the dominant organism is Pseudomonas; in addition Achromabacter cycloclastes, Flavo bacterium, Morexella and Paracolobactrum intermedium were also isolated. Some reservation was employed in naming some of the organisms which did not exactly adhere to the description in Bergey's Manual, but were further classified in accordance with Shewan, Hobbs, Hodgkiss' scheme. Most of these pure culture isolates were found to degrade the standard test LAS surfactant at a rate equal to the standard mixed shake culture inoculum. (Hancuff-Texas)
W71-00131

EFFECT OF NITROLOTIRACETIC ACID ON THE GROWTH AND METABOLISM OF ESTUARINE PHYTOPLANKTON,
Marine Water Quality Lab., West Kingston, R.I.
S. J. Erickson, T. E. Maloney, and J. H. Gentile.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part II, p R329-R335, August 1970. 7 tab, 13 ref.

Descriptors: *Growth rate, *Metabolism, *Phytoplankton, Estuaries, Chelation, Detergents, Toxicity, Degradation (Decomposition).
Identifiers: *Nitrilotriacetic acid, NTA.

The effects of nitrilotriacetic acid (NTA) on the estuarian phytoplankton was examined in natural and synthetic sea water. NTA is of low toxicity to phytoplankton in the presence of adequate trace metals. The whole molecule is likely to produce trace metals deficiency in sea water at relatively low concentration, 1 to 5 mg/l. NTA is biodegradable by estuarian bacteria, however, phytoplankton were unable to directly metabolize NTA. The time estimated for degradation of NTA to CO2, H2O and inorganic nitrogen compounds has been determined to be one day. Therefore, the residence time within estuaries should be relatively short. The degradation products in sufficient quantity are likely to promote undesirable algal blooms. The NTA molecule when degraded by bacteria loses all chelating capacity and it is unknown whether metals released from degraded NTA chelates will produce toxicity. It is possible that they would either be sufficiently diluted or immediately recomplexed with sea water and create a toxicity problem. (Hancuff-Texas)
W71-00132

THE MATHEMATICS OF ACTIVATED SLUDGE CONTROL,
Brown and Caldwell, San Francisco, Calif.
Warren R. Uhte.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1292-1304, July 1970. 1 fig, 1 tab.

Descriptors: *Mathematical model, *Activated sludge, *Control, Sludge, Kinetics, Design.
Identifiers: Suspended solids, Wasting, Computations, Process control.

For the use of the mean cell residence or the solids retention time in the control of an activated sludge system, one must select the desired time, compute the total solids present in the system and determine the total volatile solids to be wasted per day. The solids in the system may be expressed as the sum of those in the aeration facilities secondary sedimentation units and the sludge return system. Solids are wasted both over the effluent weir and through the solids disposal system. Numerical examples show these computations for conventional, step feed, high rate and multiple step operations of an hypothetical plant. Assumed plant design is for a 18 mgd flow. The plant layout includes four aeration tanks, mixed liquor channel and return activated sludge channel, and four secondary sedimentation basins. (Hancuff-Texas)
W71-00133

CANNERY WASTE WATER TREATMENT BY HIGH-RATE SPRAY ON GRASSLAND,
Robert S. Kerr Water Research Center, Ada, Okla.
James P. Law, Jr., Richard E. Thomas, and Leon H. Myers.
Journal of the Water Pollution Control Federation, Vol 42, No 9, p 1681-1631, September 1970. 8 tab, 12 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Grassland, *Sprays, *Canneries, Irrigation, Efficiencies, Cost, Nitrogen, Phosphorus.
Identifiers: Food processing.

A 12-month survey was conducted to determine the treatment and efficiency of a spray-runoff system for cannery wastes. A total of 133 inches of waste water was applied to each of 4 experimental areas. Hydrological measurements, mass removal efficiencies and soil water quality were evaluated in relation to age of the system, soil type and spray scheduling. Hydrological measurements showed that 18% of the applied water was lost through evaporative process, 61% returned to surface drains as runoff and the remaining 21% percolated through the soil. A normal once-a-day spray schedule resulted in 92% to 99% removal of the volatile solids and oxygen demanding organics, 83 to 90% removal of total nitrogen and 50% to 60% removal of the total phosphorus. The estimated capital cost of installing such a spray runoff system is approximately $1,000 per acre. The system is designed to handle up to 3.6 mgd on approximately 500 acres. Operating costs were estimated at $0.05/1000 gal of waste water treated. (Hancuff-Texas)
W71-00134

CHEMICAL AND ALLIED PRODUCTS (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
A. L. Mytelka.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1230-1231, June 1970. 11 ref.

Descriptors: *Chemicals, *Industrial wastes, *Waste water treatment, Biological treatment, Oxdation, Ozone, Radiation, Ponds.

The treatment of chemical and allied products received much attention in the literature of 1969. n addition to the traditional biological approach to reatment, the addition of external energy sources uch as chemical oxidants has been reported on a vide variety of wastes. Dilution of the waste water rom coal-tar plants with municipal waste water at a ratio of 1:7 proved satisfactory for biological reatment. It was also determined that phenols hould not exceed 70 mg/l. Bayports industrial omplex contains a central facility to treat wastes rom six industries; they are in general separated nto three categories: clean, biological, and nonacceptable. The use of aerated lagoons and ponds in efinery and chemical waste treatment is described. The reuse of phenolic-resin containing waters in a iberglass plant was determined feasible. Biological reatments were found useful in the clean-up of olyester manufacturing operations and ethylbenzene production. Ozone was used to treat waste treams in a polymer plant as well as waste water rom the production of isoprene. An investigation n the effects of radiation in treating a waste water ontaining cyanides, phenols, petroleum and reated wastes is also discussed. (Hancuff-Texas)
W71-00135

DEEP-WELL INJECTION (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
For primary bibliographic entry see Field 05E.
W71-00136

CHEMICAL CONTROL OF TREE ROOTS IN SEWER LINES,
Connecticut Agricultural Experiment Station, Storrs; California Univ., Davis; and California State Dept. of Public Works, Sacramento.
John F. Ahrens, Oliver A. Leonard, and Neal R. Townley.
Journal of the Water Pollution Control Federation, Vol 42, No 9, p 1643-1655, September 1970. 1 fig, 5 tab, 7 ref.

Descriptors: *Sewers, *Control, *Chemicals, Trees, *Plants, Pipelines, Maintenance, Herbicides, Sewage treatment, Costs, Flooding.
Identifiers: *Roots, *Collection systems.

Studies were made of hebicides that would selectively kill tree roots in sewer lines by the flood echnique. Toxicity of herbicides to roots and injury to foliage from root uptake was studied in woody ontainer grown plants first to screen herbicides nd then to determine the factors effecting toxicity n movement of metham and dichlobenil. The latter wo were also tested in sanitary sewers. Solutions of ichlobenil at 100 mg/l killed all the roots except hose of peach exposed for 10 to 60 minutes. Solutions of metham at 5000 mg/l killed most roots exposed for 1 minute or more. In sanitary sewers in acramento a one-hour flood treatment with metham, dichlobenil and combinations of the two illed all roots in the line and most of the roots in joints inspected. Metham also killed roots extending a short distance outside joints. The initial cost f chemical flooding and mechanical root removal were about the same, but chemical flooding is expected to reduce the cost of further sewer maintenance operations. The average cost of power rooting 50 miles of sewer lines was $0.11/ft including all labor, equipment and overhead. The flood method described in this paper was tested on 0,000 feet of 6 inch line. It cost $0.063/ft for hemicals and $0.053/ft for all labor, equipment and overhead. Therefore, a comparable cost of $0.113/ft was determined. (Hancuff-Texas)
W71-00137

SURFACE PROPERTIES AND ION EXCHANGE IN ALGAE REMOVAL,
California Univ., Richmond.
C. G. Golueke, and W. J. Oswald.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part II, p R304-R314, August 1970. 4 fig, 12 ref.

Descriptors: *Algae, *Harvesting of algae, *Ion exchange, Dissolved solids, Flocculation, Head loss, Hydrogen ion concentration, Chlorella, Scenedesmus, Waste water treatment.
Identifiers: *Surface charge, Regeneration, Suspended solids.

A facet of ion exchange yet to be reported in the literature is the use of ion exchange columns for the removal of cellular material having a surface charge. In experiments on the removal of algae from pond effluent it was found (1) In the presence of either strong or weak cation ion exchange resins, algal cells aggregate into tight clumps and settle in a cone-shaped mass on the top of each resin bead, (2) The aggregated cells are easily removed from the column by backwashing and retain their tendency to aggregate and settle in the displaced backwash, and (3) The exchange efficiency of the resin with respect to algal cells is but a small fraction of that with respect to cations in that the capacity for removing Mg..2, Ca..2, and other cations continues long after the capacity for removing algal cells is exhausted. Aggregation was its strongest within the pH range of 2.8 to 3.5 and dropped off sharply on either side of this range. Concentration of Na.., Ca..2, and Mg..2 from 0.5 to 4.0 millimoles did not affect the precipitation of the cells. Despite the simplicity of the process, the purity of the algal product, and the high quality of the reclaimed water attainable with it, until a regenerant less expensive than H2SO4 or HCl is found, the interest in the process must remain academic rather than economic. (Aguirre-Texas)
W71-00138

RELATIONSHIP OF CHLOROPHYLL A TO ALGAL COUNT AND CLASSIFICATION IN OXIDATION PONDS,
Lamar State Coll. of Technology, Beaumont, Tex.
Joseph V. Dust, and Adam Shindala.
Journal of the Water Pollution Control Federation, Vol 42, No 7, p 1362-1369, July 1970. 7 fig, 7 ref.

Descriptors: *Algae, *Chlorophyll, *Classification, *Oxidation lagoons, Chlorella, Oxygen demand, Photosynthesis, Respiration, Scenedesmus, Waste water treatment.
Identifiers: *Enumeration, Anacystis.

A study was conducted aimed at obtaining a quantitative comparison of chlorophyll A with the total number of organisms in the Trinity River Authority waste water treatment plant as well as a comparison with the various species of algae existing from time to time in these oxidation ponds. The literature indicates that the analytical determination of chlorophyll pigments can be accomplished spectrophotometrically with the following equation: Chlorophyll A in mg/l — (14.3) d665, where d655 is the light absorbance at a wave length of 655 millimicrons and a slit width of 0.3 mm. Eight major types of algae were found in significant numbers: Oocystis, Anacystis, Chlorella, Desmids, Scenedesmus, Coelastrum, Zygnema, and Closterium. The Anacystis organism was found more frequently and in greater numbers than any other organism. The average weekly count of Anacystis varied from about 1 to 4 million per ml during the first 15 weeks of the study comprising the summer and early fall months of the year. Chlorella and Scenedesmus were the predominant organisms during the late fall, winter, and early spring months, with cell counts of 10,000 to 100,000 cells/ml. A relationship between chlorophyll A and total algal count was not found. However, a definite relationship existed between the amount of chlorophyll A and the number of Anacystis organisms present. A similar relationship was found with Zygnema. (Aguirre-Texas)
W71-00139

WATER POLLUTANT OR REUSABLE RESOURCE.

Environmental Science and Technology, Vol 4, No 5, p 380-382, May 1970. 2 fig.

Descriptors: *Waste water treatment, *Industrial wastes, Water resources, Deep wells, Waste disposal, Liquid wastes.
Identifiers: *Steel industry, *Pickling liquor, Recovery, Regeneration.

Spend liquor is an aqueous solution containing from about 0.5 to 10% acid and perhaps 12% iron. Either undissolved or in solution, if discharged untreated to a waterway it is a twofold menace, first for its acid content and second for its iron content. Depending on the chemical and physical form of the iron the liquor may turn the water muddy brown, deposit slime, and exert a strong oxygen demand. Huge amounts of pickling acid, 35 to 40 lbs for every ton of steel are used in the finishing operations. It is estimated that 8 to 15 gallons of spent liquor are produced per ton of steel pickled. Since 50,000,000 tons of steel are pickled every year, spent liquors are produced at a rate of half a billion gallons per year. There are essentially six types of approaches that can be taken for the disposal of spent pickle liquor: (1) discharge to a waterway, (2) deep well disposal, (3) neutralization, (4) hauling by contractor, (5) recovery processes, (6) regeneration processes. The fact that a few of the available recovery and regeneration methods are in actual use in the steel industries seems to be a reflection not so much on the technical uncertainties of these methods but of the fact that much simpler if less effective ways of disposal are still open, consistent to whatever local regulations are in effect. (Hancuff-Texas)
W71-00140

FEASIBILITY OF HYDROLYSIS OF SLUDGE USING LOW PRESSURE STEAM WITH SO-2 AS A HYDROLYTIC ADJUNCT AND UTILIZATION OF THE RESULTING HYDROLYSATE.
Federal Water Pollution Control Administration, Washington, D.C.

Available from NTIS as PB-194 784, $3.00 in paper copy, $0.95 in microfiche. Federal Water Pollution Control Administration Research Series, Report 17070 EKN 12/69, December 1969. 30 p, 5 fig, 9 tab, 10 ref. FWPCA Project 17070 EKN-12/69, Contract No 14-12-188.

Descriptors: *Activated sludge, *Hydrolysis, *Sludge disposal, Proteins, Byproducts, Waste disposal, Chemical reactions, Chemical degradation.
Identifiers: Sludge hydrolysis.

Sulfurous acid, when used with hydrolysis in the treatment of activated sludge, will increase soluble solids, improve filtration efficiencies and reduce moisture content of the resultant filter cake. Use of a 0.5% sulfurous acid and hydrolytic treatment of sludge at 140C for one hour increased the soluble solids content of the activated sludge by 20%. Concentration of the solubilized extract produced a syrup; 85% of the solids content of the syrup was organic. By TKN estimates, over 20% of these solids were proteinaceous. An amino acid analysis indicated it could be of value as an animal feed, and this was confirmed in rat feeding studies (at a 10% level in the diets) showing an efficiency of food utilization of 42 for the organic molasses as compared to 39 for cane molasses. (Knapp-USGS)
W71-00164

ELECTRODIALYSIS OF ESTUARINE WATER,
Metcalf and Eddy, N.Y.
George P. Fulton.
Journal of the American Water Works Association, Vol 62, No 9, p 549-554, September 1970. 6 p, 5 fig, 3 tab, 1 ref.

Descriptors: *Waste water treatment, *Droughts, *Estuaries, *Electrodialysis, *Economics, Municipal water, Water costs, Cost analysis, Water quality, Salinity, Saline water, Water resources development, Cost-benefit analysis.
Identifiers: Estuarine water resources.

The major features of design and operation that should be taken into account when electrodialysis (ED) is considered as a method to supplement existing municipal water supplies with water from river estuary sources are reviewed. What is of paramount importance, in considering a river source that is influenced by tidal action, is the specific location of the electrodialysis plant. Such location will influence both the cost of transmission of treated water to the water supply system, and the cost of the treatment, due to variations in raw water quality. In general, an ED facility must be located along a reach of river where a solids content of above 3,000 mg/liter would occur for only limited periods of time, for both normal and drought conditions. At times of drought conditions, the salt front will move farther upstream than during normal periods. In general, the electrodialysis treatment of estuary sources is a reasonable method for supplementing existing water supplies. Each specific situation where ED may be utilized, however, must be evaluated on its own merits, considering all logic alternative methods of supply. (Knapp-USGS)
W71-00214

MANAGING WASTE HEAT WITH THE WATER COOLING TOWER,
Marley Co., Kansas City, Mo.
Joe Ben Dicky, Jr, and Robert E. Cates.
Marley Company, Kansas City, April 1970. p 14, 9 fig.

Descriptors: *Temperature, *Cooling towers, Heat transfer, Costs, Optimization, Waste water treatment, Water pollution control.

One solution to the problem of stream heating by the electric utility industry lies in the use of water cooling towers. Various operating needs include small unit municipals through syndicates operating multiple units aggregating over 5000 megawatts. Operating conditions include constant on-line recirculating, stand-by or 'trim' duty, and once through systems to limit terminal differences. Types of towers discussed are: larger induced draft, forced and assisted draft, natural draft, and the DriTower. Geographical aspects of design and operating problems are outlined. Accompanying the discussion is a presentation of evaluation factors including methods of selection and optimization of both mechanical and natural draft cooling towers. (Upadhyaya-Vanderbilt)
W71-00232

POTENTIAL THERMAL EFFECTS OF AN EXPANDING POWER INDUSTRY: OHIO RIVER BASIN I,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-00235

COOLING TOWERS - A TECHNOLOGICAL TOOL TO INCREASE PLANT SITE POTENTIALS,
Marley Co., Kansas City, Mo.
J. O. Kadel.
American Power Conference, Chicago, April 23, 1970. 15 p, 6 fig, 1 tab.

Descriptors: *Temperature, *Cooling towers, Nuclear powerplant, Evaporation, *Water demand, Waste water treatment.
Identifiers: Fossil fueled plant, Bleed water.

Water demand as related to the water cooling tower system is discussed. For fossil fueled electric generating plants, the waste heat rejected to the cooling water system is on the order of 4,500 BTU per kilowatt-hour of energy generated. A one million kw fossil-fueled plant would require the evaporation of approximately 6,750 gallons of water each minute of operation. A limiting factor for site development is quantity and temperature limits of dependable water supply. The total water demand and proportionate amounts alloted to bleed can readily be compared by examining the curves shown in the paper. Total water demand can vary up to a ratio of 2 to 1 depending on the hardness of the local water. Through careful application of water cooling towers, the power generation potential of plant sites can be increased to a desired level, even if natural water supplies are relatively low. (Upadhyaya-Vanderbilt)
W71-00237

A DISPOSAL SYSTEM FOR AGRICULTURAL WASTE WATERS IN THE SAN JOAQUIN VALLEY OF CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
R. J. Pafford, Jr., and Edgar P. Price.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.407-26.419, Mexico City, 1969. 13 p, 2 fig, 1 tab, 6 ref.

Descriptors: *Drainage water, Drains, Drainage, Irrigated land, *Waste water disposal, Irrigation effects, Subsurface drainage, Waste water, *Disposal, Return flow, Nutrients, Salinity, Water chemistry, Waste water treatment, Water conveyance, Irrigation, Water pollution, Drainage engineering, Drainage systems, Insecticides.
Identifiers: *San Luis Drain (Calif), San Joaquin Valley (Calif), Open drains, Salt removal, Drainage yield.

Events and conditions leading to the construction of the 188-mi-long San Luis Drain to dispose of agricultural waste water from a large irrigated area on the west side of the San Joaquin Valley in California are described. Estimated amounts of drainage water and chemical concentrations for initial and future operation of the drain are presented. Alternative disposal plans and effects of the waste water on the receiving waters in the Sacramento-San Joaquin Delta and the San Francisco Bay area are discussed. Nitrogen concentration is the principal objectionable feature of the waste water. A 3-yr interagency research program to determine the most economical method for removing nitrate-nitrogen from drainage waters is discussed. (USBR)
W71-00263

A METHOD FOR THE TREATMENT OF ANIMAL WASTES TO CONTROL AMMONIA AND OTHER ODORS,
Vineland Labs., Inc., N.J. Research Div.
William Seltzer, Stanley G. Moum, and Tevis M. Goldhaft.
Poultry Science, Vol 48, No 6, p 1912-1918, November 1969. 4 tab, 10 ref.

Descriptors: *Odor, *Ammonia, *Farm wastes, Air pollution, Poultry, Hogs, Cattle, Bactericides.
Identifiers: Paraformaldehyde, Methogen, Odor control, *Manure odors.

Discusses the use of flaked paraformaldehyde for direct treatment of animal wastes to prevent or eliminate the noxious gases from animal quarters. Paraformaldehyde is a mixture of polyoxymethylene glycols containing 90-99% polymerized formaldehyde. Paraformaldehyde liberates formaldehyde gas as it decomposes. For many years ammonia gas has been used to neutralize formaldehyde gas. This work is predicated on using the principal in reverse. The action of the flake paraformaldehyde on the animal wastes was concluded to be both chemical and antimicrobial and these combined actions make it of value in the control of noxious odors and gases emanating as a result of bacterial fermentation. (Miner-Iowa State)
W71-00332

AN IMPROVED METHOD FOR SEPARATE COLLECTION OF URINE, FECES, AND EXPIRATORY GASES FROM THE MATURE CHICKEN,
Agricultural Research Service, Fargo, N. Dak. Metabolism and Radiation Research Lab.
G. D. Paulson.
Poultry Science, Vol 48, No 4, p 1331-1336, 1969. 3 fig, 7 ref.

Descriptors: *Farm wastes, *Urine, *Poultry, Sampling, Carbon dioxide.
Identifiers: Surgical modification, Poultry urine collection, Metabolism cage.

An improved method for surgical modification of the chicken and collection apparatus to facilitate separate collection of urine and feces is described. There was no mortality from surgery, and the modified birds were normal, as evaluated by outward appearance, feed and water consumption, urine and feces excretion, and post examination of sacrificed birds. A metabolism unit and a system for collecting respiratory CO2 from the chicken are also described. (Miner-Iowa State)
W71-00333

HOUSEFLY LARVAE: BIODEGRADATION OF HEN EXCRETA TO USEFUL PRODUCTS,
Agricultural Research Service, Beltsville, Md.
C. C. Calvert, N. O. Morgan, and R. D. Martin.
Poultry Science, Vol 49, No 2, p 588-590, March 1970. 2 tab, 3 ref.

Descriptors: *Farm wastes, *Livestock, *Manure, *Poultry, Insects, Waste treatment, Ultimate disposal, Waste disposal, Odor.
Identifiers: House fly, Hen, Fly eggs, Manure treatment, Waste utilization.

This report presents the results of experiments to establish the concentration of fly eggs that can be used to process hen excreta most efficiently, and a means of separating the house fly pupae from the processed hen excreta and to simplify their collection. Within four days after seeding with house fly pupae the odor of the manure became unobjectionable. After eight days the excreta was reduced to an essentially odorless and friable material. The separated pupae were utilized as a protein source in the diet of growing chicks. (Miner-Iowa State Univ)
W71-00334

AEROBIC TREATMENT OF LIVESTOCK WASTES,
Illinois Univ., Urbana. Agricultural Experiment Station.
D. D. Jones, D. L. Day, and A. C. Dale.
University of Illinois Agricultural Experiment Station Bulletin 737, 1970. 55 p, 26 fig, 4 tab, 45 ref. HEW Grants EC-00245 and EC-00244.

Descriptors: *Oxidation lagoons, *Aeration, *Farm wastes, *Biochemical oxygen demand, Organic matter, Sludge disposal, Oxygenation, Hogs, Cattle.
Identifiers: *Oxidation ditch, *Aerobic lagoon, Livestock waste properties, Biochemical properties, Aerobic treatment, Irrigation system.

This report emphasizes the aerobic method of storage and treatment of livestock wastes primarily becuase of the low level of odors associated with aerobic treatment. An introduction to the theory of aerobic treatment is presented along with several laboratory experiments on swine, dairy cattle, and

poultry wastes. These laboratory experiments verified the use of the aerobic method for livestock wastes. Two methods of aerobic treatment were studied and the results summarized. These were (A) the in-the-building oxidation ditch and (B) the aerobic lagoon (oxidation pond and aerated lagoon). Recommendations are made as to operator convenience, capacity, and design of the different systems. (White-Iowa State)
W71-00339

EFFECT OF MANURE APPLICATION, AERATION, AND SOIL pH ON SOIL NITROGEN TRANSFORMATIONS AND ON CERTAIN SOIL TEST VALUES,
Wisconsin Univ., Madison. Dept. of Soils.
R. J. Olsen, R. F. Hensler, and O. J. Attoe.
Soil Science Society of America Proceedings, Vol 34, No 2, p 222-225, March-April 1970. 2 fig, 2 tab, 10 ref.

Descriptors: *Nitrification, *Denitrification, *Farm wastes, *Aeration, Soil tests, Rates of application.
Identifiers: N recovery, Field moisture capacity, *Soil nitrogen transformations, Soil pH, Nitrate production.

Nitrate production under aerobic conditions was directly related to rate of manure application, period of incubation and soil pH, but was stopped under anaerobic conditions. Average recovery by chemical analysis of N applied as manure to a Plainfield sand at relatively high rates and incubated for 37 weeks was 77% for aerobic conditions and 24% for anaerobic conditions. The addition of manure tended to increase soil pH and the contents of organic N, available P and exchangeable K, Ca, and Mg, particularly at the higher rates. They also increased the field moisture capacity of a Plainfield sand. However, on an acid Ella loamy sand the two highest rates of manure caused a reduction of the values for field moisture capacity, apparently the result of formation of a waxy material that tended to repel water absorption. (Miner-Iowa State)
W71-00341

LIVESTOCK WASTE MANAGEMENT STUDIES-TERMINATION REPORT,
Illinois Univ., Urbana. Agricultural Experiment Station.
D. L. Day, D. D. Jones, and J. C. Converse.
HEW Project No EC-245. July 1970. 97 p, 75 fig, 14 tab, 7 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, *Chemical oxygen demand, *Odor, Hogs.
Identifiers: *Livestock oxidation ditch, Loading rates, Ditch mixed liquor, Optimum aerobic degradation, Aeration rotors, Operating cost, Feeding value of oxidation ditch solids.

This report deals mainly with results from laboratory tests and field trials of oxidation diches. Different loading rates were studied, and solutions to the problem of foaming were discussed. Most of the work was done with swine although laboratory tests were made with beef and dairy animals. Some research was done to determine the feeding value of oxidation ditch solids. The oxygenation capacity of rotors was discussed. A laboratory study of the minimum aeration for odor control was made using set design criteria. (White-Iowa State)
W71-00342

OXIDATION DITCHES CAN ELIMINATE ODORS, MANURE HANDLING AND POLLUTION,
John Russell.
Farm Journal, Vol 94, No 8, p H-10, H-15, August 1970.

Descriptors: *Farm wastes, *Hogs, *Waste treatment, Activated sludge, Odors, Aeration.
Identifiers: *Oxidation ditch, *Hog confinement, Odor control, Smart Pork Farm, Lawrence (Kans).

The use of oxidation ditches is described in a swine confinement system for 5000 head annually near Lawrence, Kansas. Thousand head finishing buildings have two oxidation ditches each with 4 rotors or wheels in each ditch. Organic matter removal is in excess of 90 percent. Operating costs approximate one dollar per head. Effluent is discharged to holding ponds for evaporation thereby eliminating all manure hauling. (Miner-Iowa State)
W71-00343

THE BENEFICIAL USE OF STORM WATER, FINAL REPORT, A SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT, AND REUSE OF STORM WATER.
Hittman Associates, Inc., Columbia, Md.

Available from NTIS as PB-195 160, $3.00 in paper copy, $0.95 in microfiche. Report No HIT-344, August, 1968. 404 p, 91 tab, 102 fig, 46 ref, 8 append. FWQA Project 11030 DNK 08/68, Contract 14-12-20.

Descriptors: Waste water treatment, *Water reuse, Optimization, *Storm runoff, *Water storage, *Water pollution control, *System analysis, Maryland.
Identifiers: Storm water, Combined sewers, Columbia (Maryland).

This final report covers the work performed by Hittman Associates, Inc. in cooperation with The Rouse Company and the 'new city' of Columbia, Maryland, on the collection, storage, treatment, and reuse of storm water as a means of pollution control and water supply augmentation. A discussio· of the work performed in the analysis and optimization of the system; the conceptual designs of potable, sub-potable, and pollution control systems; the conceptual design of a system for controlling pollution using a 'conventional design' appraoch, the results of the system evaluation and plans for the demonstration of the local storage, treatment, and reuse of storm water. The appendicies to this report include the derivations of the hydrology equations, survey reports on water usage and the public acceptance and legal aspects of reuse, design reports on the 'conventional' and demonstration system, detailed estimates on the cost of the demonstration program, and descriptive information on packaged water treatment plants.
W71-00409

TREATMENT OF WASTE EATER - WASTE OIL MIXTURES.
Armco Steel Corp., Middletown, Ohio.

Available from NTIS as PB-195 161, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402--Price $2.50. 167.13/4; 12010 EZV 02/70. Water Pollution Control Research Series 12010 EZV 02/70, May, 1970. 137 p, 22 tab, 25 fig, 32 ref, 7 append. FWQA Program 12010 EZV, Grant No WPRD-169-01-68.

Descriptors: Waste water treatment, *Industrial wastes, *Emulsions, *Coagulation, Flocculation, *Oil wastes, Flotation, Kinetics, Zeta potential.
Identifiers: *Steel wastes.

Cold reduction of steel strip results in the production of large quantities of waste water containing variable amounts of oil. A five stand tandem cold mill located at Armco Steel Corporation's Ashland, Kentucky Works produces 200 to 500 gpm of waste water containing 400 to 4,000 ppm of oil. The COD of the waste varies from 400 to 20,000 ppm. A treatment process and facility was developed, constructed, and demonstrated, on full scale, for the treatment of cold mill wastes. The treatment process utilized chemical coagulation to break the emulsions. The chemicals employed included alum, lime, clay and organic polyelectrolyte. The process consisted of the following treatment steps; equalization, chemical addition and rapid mixing, flocculation, and dissolved air flotation. A number of treatment variables were studied in the laboratory and in the field in order to establish process kinetics and otpimum treatment efficiency. Zeta potential, streaming current, and particle size distribution were used in laboratory studies to describe the effect of the following variables in process kinetics; acid number, initial oil concentration, type of emulsifier, chemical dosage, order of chemical addition, reaction time, and final pH. Based on these studies, an hypothesis of the emulsion breaking mechanism was proposed. Oil, COD, and turbidity were used in field studies to establish the effect of the following variables on treatment efficiency; chemcial concentration, order of chemical addition, chemical mixing time, flocculation mixing time and speed, and air flotation time and recirculation rate. Based on these studies, design criteria and operating costs for this process were presented.
W71-00410

FEASIBILITY OF A STABILIZATION-RETENTION BASIN IN LAKE ERIE AT CLEVELAND, OHIO.
Havens and Emerson, Cleveland, Ohio.

Available from NTIS as PB-195 083, $3.00 in paper copy, $0.95 in microfiche. Report, May, 1968. 145 p, 22 tab, 34 fig, 38 ref, 3 append. FWQA Project 11020---05/68, Contract No 14-12-27.

Descriptors: Lake Erie, Waste water treatment, *Oxidation lagoons, Ohio, Retention, Water storage, *Settling basins, Costs, Evaluation, Pollution abatement.
Identifiers: Cleveland (Ohio), *Stabilization-retention basins, *Collection systems.

A feasibility study was conducted of a large stabilization-retention basin to constructed in Lake Erie at Cleveland, Ohio. The stabilization is viewed as a possible alternative to separation of a combined sewer system. The proposed basin would treat flows from a number of large combined sewer overflows, from several polluted streams, and effluent from a large secondary wastewater treatment plant. Treatment would consist of bio-oxidation, sedimentation, stabilization and disinfection. A shoreline collection system is included to convey flows to the basin. The chemical, biological, physical and structural aspects of the proposed basin were studied, and the probable benefits to water quality and the effectiveness of the basin as a treatment device were evaluated. Estimates of cost of the basin and collection system were prepared, and it was concluded that the stabilization basin would provide a higher degree of pollution abatement than would separation of sanitary and storm sewers, at about one-third the cost.
W71-00411

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWER OVERFLOWS - BUCYRUS, OHIO.
Burgess and Niple Ltd., Columbus, Ohio.

Available from the NTIS as PB-195 162, $0.95 in microfiche. Also for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402--Price $2.00. 167.13/4; 11024FNK11/69. Water Pollution Control Research Series 11024 FKN 11/69, November 1969. 197 p, 30 tab, 67 fig, 59 ref. FWQA Project 11024 FKN, Contract No 14-12-401.

Descriptors: Drainage, Hydrographs, Infiltration, *Water pollution control, Interception, Sewers, *Overflow, Urbanization, Ohio, *Pollution abatement, Waste water treatment, Storm runoff.
Identifiers: *Combined sewers, *Interceptor sewers, *Urban runoff, Bucyrus (Ohio), *Sewer overflows.

This report contains the results of a detailed engineering investigation and comprehensive techni-

cal study to evaluate the pollutional effects from combined sewer overflows on the Sandusky River at Bucyrus, Ohio and to evaluate the benefits, economics and feasibility of alternate plans for pollution abatement from the combined sewer overflows. The City of Bucyrus is located near the upper end of the Sandusky River Basin which is tributary to Lake Erie. Bucyrus has an incorporated area of about 2,340 acres, a population of 13,000, and a combined sewer system with an average dry weather waste water flow of 2.2 million gallons per day. A year long detailed sampling and laboratory analysis program was conducted on the combined sewer overflows in which the overflows were measured and sampled at 3 locations comprising 64% of the City's sewered area and the river flow was measured and sampled above and below Bucyrus. The results of the study show that any 20 minute rainfall greater than 0.05 of an inch will produce an overflow. The combined sewers will overflow about 73 times each year discharging an estimated annual volume of 350 million gallons containing 350,000 pounds of BOD and 1,400,000 pounds of suspended solids. The combined sewer overflows had an average BOD of 120 mg/l, suspended solids of 470 mg/l, total coliforms of 11,000,000 per 100 ml and fecal coliforms of 1,600,000 per 100 ml. The BOD concentration of the Sandusky River, immediately downstream from Bucyrus, varied from an average of 6 mg/l during dry weather to a high of 51 mg/l during overflow discharges. The suspended solids varied from an average of 49 mg/l during dry weather to a high of 960 mg/l during overflow discharges. The total coliforms varied from an average of 400,000 per 100 ml during dry weather to a high of 8,800,000 per 100 ml during overflow discharges. Various methods of controlling the pollution from combined sewer overflows are presented along with their degree of protection, advantages, disadvantages and estimates of cost. The methods presented include (1) COMPLETE SEPARATION, (2) interceptor sewer and lagoon system, (3) stream flow augmentation, (4) primary treatment, (5) chlorination, and (6) offstream treatment. It was concluded that the most economical method of providing a high degree of protection to the Sandusky River is by collecting the combined sewer overflows with a large interceptor and using an aerated lagoon system to treat the waste loads from the overflows.
W71-00412

MICROWAVE IRRADIATION OF POTATO WASTE WATER,
Manitoba Univ., Winnipeg. Dept. of Electrical Engineering.
M. A. K. Hamid, W. M. Boerner, and S. C. Tong.
Available from NTIS as AD-711 247, $3.00 in paper copy, $0.95 in microfiche. Journal of Microwave Power, Vol 5, No 1, p 44-46, Feb 1970.
Identifiers: *Water pollution, *Potatoes, *Microwaves, Water pollution, Food, Control, Bacteria, Canada, Potato processing, *Food processing, *Water pollution control equipment, *Microwave sterilization.

Preliminary experiments designed to investigate the sterilization of polluted potato-waste water suggest that microwaves may stimulate the growth of aerobic bacteria, which have a high oxygen demand, and may on the other hand reduce the number of photosynthetic bacteria. These observations have yet to be confirmed with further experimentation as the study continues.
W71-00417

WATER AND SEWER REPORT.
Essex County Planning Board, Belleville, N.J.

Available from NTIS as PB-192 356, $3.00 in paper copy, $0.95 in microfiche. Planners Associates, Inc, Newark, NJ, December 1969. 146 p.
Identifiers: *Management planning, *New Jersey, Economics, *Water suppl)ies, Urban planning, *Sewage, Urban areas, Statistical data, Wastes (Sanitary engineering, Costs, Water pollution, Chlorine compounds, Programming (Computers), Mathematical models, Maps, *Essex County (N J), Area planning and development, Water quality, Water analysis, Sewage treatment.

The report inventories all public and private water and sewer systems in Essex County and the 22 municipalities therein. It then forecasts the 1990 demand for water and sewer services and formulates a plan meeting these demands. The costs for implementing all elements of the recommended plan are included in the capital improvements program.
W71-00420

PRELIMINARY REGIONAL PLAN FOR WATER AND SEWERAGE FACILITIES.
East-West Gateway Coordinating Council, East St. Louis, Ill.

Available from NTIS as PB-192 093, $3.00 in paper copy, $0.95 in microfiche. September 1969. 79 p.
Identifiers: *Sanitary engineering, *Urban areas, *Urban planning, *Missouri, *Management planning, *Illinois, Water supplies, Sewage, Population, Advanced planning, Statistical data, Problem solving, East West Gateway area, *Saint Louis (Missouri), Stormwater.

The report discusses the major water supply, sewage treatment, and storm water problems in the area. Separate sections deal with water supply and an evaluation of water plant capacities, with sewage treatment problems and ratings of treatment plants according to present and future abilities to meet existing standards, and with major storm water problems.
W71-00421

WATER AND SEWER FINANCIAL PLAN.
Chatham County-Savannah Metropolitan Planning Commission, Savannah, Ga.
For primary bibliographic entry see Field 06C.
W71-00422

INDUSTRIAL WATER USAGE AND WASTE DISPOSAL IN THE IRON AND STEEL INDUSTRY,
Iscor Works, Vanderbijl Park (South Africa).
S. Erasmus.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 9 p, 3 tab.

Descriptors: *Water utilization, *Water reuse, Effluents, Steel, Industrial wastes, Water pollution, Recirculated water, Reclaimed water.
Identifiers: *Iron and Steel Industry, South Africa.

Emphasis is laid on the correct interpretation of the often abused water usage terms like 'consumption' and 'application rate'. Consumption losses in a steel mill amount to 45 to 50% of daily make-up which could probably only be reduced by the introduction of air cooled units. The need for superior quality water for specific applications is emphasized and that the most effective use is based on the cascading and inplant circulating systems. Although recirculation systems are prerequisites for optimum water utilization it does not necessarily decrease consumption use. Such practice often leads to the same weight of pollution in smaller discharges which could result in unacceptable quality effluents. This discourages intensive reuse of water. (Selby-Texas)
W71-00424

PLANNING AND CONSTRUCTION OF WASTE WATER RECLAMATION SCHEMES AS AN INTEGRAL PART OF WATER SUPPLY,
G. J. Stander, and A. J. Clayton.
1970 Conference of the Institute of Water Pollution Control, Cape Town, South Africa (Southern African Branch), March 16-20, 1970. Preprint, 11 p, 2 tab, 4 fig.

Descriptors: *Water consumption, *Water reuse, Effluents, Costs, Waste water treatment, Tertiary treatment.
Identifiers: *South Africa, Internal Reuse.

Statistics presented indicate South Africa is heading for a substantial water shortage on a basis of current usage technology. This forces an acceptance of the fresh water supply, beneficial use and reuse of water, waste water management, and reclamation and the control of pollution are inseparable components in a broad water conservation plan. Reuse of water and reclamation of effluents arising from unit processes in a factory can result in a saving on water consumption of between 50 and 90%. A table compares water requirements of several industries before and after reclamation and reuse. In industrialized urban areas, which account for only about 17% of current daily water usage, 60 to 100% of water intake reaches sewage purification facilities, so it is economically and strategically sound to exploit purified effluents. Predicted water consumption and production patterns are discussed along with the total treatment costs. It will be more advantageous in the future to subsidize local authorities to reclaim their effluents than to develop new water schemes involving the piping of water over long distances. (Selby-Texas)
W71-00427

THE LOCAL GOVERNMENT PRESPECTIVE ON WASTE WATER,
E. J. Hall.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 24 p, 4 fig, 3 tab, 12 ref.

Descriptors: *Water Resources, *Political aspects, Local governments, Waste water disposal, Water pollution, Reuse, Waste water treatment.
Identifiers: *South Africa.

By the year 2,000 the water demand in the Republic of South Africa will just about equal the total water supply from all natural sources. But due to geographical distribution of the areas of supply and demand, equitable allocation of all stored water to the demand centers would be impractical. Prime supply as a general rule will be inadequate in developed regions by this time. The dimensions of the problem of waste water control are not fully appreciated even by professional men in local government directly concerned with waste water purification, and there is an urgent need for forward planning. It is of the utmost importance that the State and its departments, which have the ultimate responsibility, should understand in full the dilemma of the local authority. A sympathetic and understanding cooperation between these two levels of government is essential if success is to be achieved. (Selby-Texas)
W71-00428

OBJECTIVES OF WATER POLLUTION CONTROL AND THE PROBLEMS OF THEIR ACHIEVEMENT,
G. Mann.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 14 p.

Descriptors: *Water pollution control, *Legislation, Local government, Reuse, Waste water treatment.
Identifiers: *South Africa.

The basis of pollution control treatment as it affects industrial effluents should be one of prevention, and in this respect every endeavor is brought to bear on industrialists local governments, provincial authorities and state departments to make provision for control methods, physical or chemical or both, at their source. Besides control by legislation there are the ethical aspects to be considered as well. Industrialists must also be concerned for the good of South Africa to do all that is in their power

as well as in their interests to exercise the maximum control over water they use, the discharge and disposal of the industrial effluents, and the reuse of purified effluents. (Selby-Texas)
W71-00429

WATER AND WASTE MANAGEMENT IN THE CAPE TOWN METROPOLITAN AREA,
S. S. Morris.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 44 p, 19 ref.

Descriptors: *Waste treatment, *Water Resources, Reuse, Waste disposal, Waste water treatment, Water management (Applied).
Identifiers: *South Africa.

The history is reviewed of the development of water and waste management in the Cape Town metropolitan area of South Africa beginning with the occupation of that country by the white races. The country's water supply is discussed including the role of reused sewage and industrial effluents as a water resource. Liquid and solid wastes disposal systems are also discussed including the various pollution investigation and control organizations. (Selby-Texas)
W71-00431

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS, PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWERS BY HIGH-RATE, FINE-MESH SCREENS.
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.

Available from NTIS as PB-195 168, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series DAST-5, 11023 FDD 03/70, March 1970. 69 p, 19 tab, 24 fig, 3 append. FWQA Program 11023 FDD, Contract 14-12-128.

Descriptors: *Screens, *Overflow, *Sewage treatment, Waste water treatment, Storm runoff, Cost analysis, Evaluation, Cost comparisons, Treatment facilities.
Identifiers: *Rotary screens, *Combined sewers, Sewer overflows.

The objective of this study was to determine the feasibility, effectiveness, and economics of employing high-rate, fine-mesh screening for primary treatment of storm water overflow from combined sewer systems. The final form of the screening unit stands 63 inches high and has an outside diameter of 80 inches. The unit is fed by an 8-inch pipe carrying 1700 gpm (122 gal/min/ft2) which is distributed to a 60-inch diameter rotating (60 rpm) stainless collar screen having 14 square feet of available screen area and a 165 mesh (105 micron opening, 47.1 percent open area). The screen backwashed at the rate of 0.235 gallons of backwash water per 1000 gallons of applied sewage. Based on final performance tests run on dry-weather sewage, the unit is capable of 99 percent removal of floatable and settleable solids, 34 percent removal of total suspended solids and 27 percent removal of COD. The screened effluent is typically 92 percent of the influent flow. On the basis of a scale-up design of a 25 mgd screening facility, the estimated cost of treatment is 22 cents/1000 gallons. No finite cost comparisons were made with other treatment methods; however, when compared to conventional primary sedimentation, the selection of a screening facility as a treatment method is dependent on the value and availability of land, the design capacity of the treatment facility, the character of rainfall and runoff, and the available means of disinfection. It was observed that the proposed screening facility required 1/10 to 1/20 the land required by a conventional primary treatment plant.
W71-00476

PROPOSED COMBINED SEWER CONTROL BY ELECTRODE POTENTIAL.
Merrimack Coll., North Andover, Mass.
For primary bibliographic entry see Field 05G.
W71-00479

MULTIPLE PHASE EJECTOR PILOT PLANT,
Kaye (Joseph) and Co., Inc., Cambridge, Mass.
For primary bibliographic entry see Field 03A.
W71-00482

PRELIMINARY WASTE WATER REPORT FOR THE OUTER AREA.
Northeastern Illinois Planning Commission, Chicago.

Financed in part with a planning grant from the HUD under Section 701 of the Housing Act of 1954. July 1970. 208 p, 37 fig, 48 tab, 146 ref.

Descriptors: *Waste water treatment, *Waste water, *Water quality control, *Water management, *Water pollution, *Illinois, *Water pollution control, *Water quality act, *Regional analysis, *Planning, *Urbanization, *Local governments, *Treatment facilities, Waste water pollution, Industrial wastes, Sewers, Municipal wastes, Construction costs, Evaluation, Analysis.
Identifiers: *Northeastern Illinois, Metropolitan planning, Agricultural wastes, Physiography, Comprehensive plan.

This preliminary report presents information on existing waste water treatment facilities in four of the six counties comprizing the Northeastern Illinois Metropolitan Area. It also summarizes the estimated future requirements and costs for waste water treatment in each county to the year 2,005. The counties include all of McHenry, Kane and Will counties and that portion of Lake County that is not served by the North Shore Sanitary District. Statistical and technical data are presented on each county to describe population trends and estimates, land use, topography, drainage, water supply, climate, and exisiting waste water disposal facilities, problems and alternative solutions. In some cases, proposed solutions involve the creation of a county public works department or county public health department to acquire, improve, construct and operate county treatment facilities or to provide advisory service to independently operated facilities. Other solutions, involving subregional or district waste water agencies and continuation of operations of existing plants by individual municipalities and industrial plants, are also evaluated. The relationship of these possible solutions to the comprehensive general plan of the entire region is discussed. The appendix includes the Illinois Water Quality Standards and sections on animal wastes and nutrients. The publication is intended for review purposes and is not considered to be in its final form. (See also W71-00486) (Poertner)
W71-00485

PRELIMINARY WASTE WATER PLAN FOR THE INNER AREA; SUPPLEMENT NO. 1, RECOMMENDED PLAN FOR DUPAGE COUNTY.
Northeastern Illinois Planning Commission, Chicago.

Financed in part with planning grant from the HUD under Section 701 of Housing Act of 1954. July 1969. 74 p, 11 fig, 10 tab, 11 ref.

Descriptors: *Waste water treatment, *Evaluation, *Analysis, *Waste water, *Water quality, *Water management, *Water pollution, *Illinois, *Water pollution control, *Urbanization, *Planning, *Treatment facilities, *Local governments, Sewers, Municipal wastes, Waste water pollution.
Identifiers: *Northeastern Illinois, *DuPage County, Metropolitan planning, Comprehensive plan.

Four proposed plans are analyzed for providing waste water treatment and disposal facilities to meet the increasing needs of DuPage County, the most rapidly growing county in Illinois. It lies immediately west of Cook County. The factors that are considered in the analyses and comparisons illustrate thoughtful and far reaching evaluation of alternatives. The study exemplifies some philosophies that should be considered by those planning the waste water facilities for other rapidly growing counties. Two of the proposed systems included a single treatment plant together with extensive systems of large diameter interceptor sewers. Another plan proposed eight treatment plants, and another proposed eleven. Each of the latter two systems involved less extensive systems of smaller diameter interceptor sewers. In addition to capital, operating and maintenance costs, the comparisons included consideration of water reuse, the loss of flood plain storage to urbanization when sewers are provided, the relationship of proposed sewer routes to existing mass transportation routes, the potentials for staged construction, urgan drainage potentials, relationships of existing forest preserves, opportunities for open space acquisitions, and financing, administrative and management opportunities and problems. The eight plant system, under County management, was recommended. This publication is intended for review purposes. (See also W71-00485) (Poertner)
W71-00486

5E. Ultimate Disposal of Wastes

DISPOSAL OF RADIOACTIVE WASTES FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES, 1969,
Naval Ship Systems Command, Washington, D.C.
J. J. Mangeno, and M. E. Miles.
Radiological Health Data and Reports, Vol 11, No 8, p 373-377, August 1970. 5 p, 3 tab, 9 ref.

Descriptors: *Radioactive waste disposal, *Ships, *Nuclear wastes, *Monitoring, *Harbors, Nuclear reactors, Water pollution sources, Water pollution control.
Identifiers: Nuclear-powered ships, U. S. Navy.

This report summarizes data on disposal of radioactive wastes from U. S. Naval nuclear-powered ships and their support facilities and summarizes results of environmental monitoring performed to confirm adequacy of waste disposal limits and procedures. The total long-lived radioactivity in liquid waste discharges associated with operation and maintenance of Naval nuclear-powered ships totaled 0.05 curies in 1969 for all harbors. This is comparable to the average of 0.2 curies discharged per year during the preceding 3 years for all harbors and is less than the average of 4 curies reported discharged per year during the preceding 5 years. No increase in radioactivity above normal background levels has been detected in harbor water. Discharges of liquid wastes from U. S. Naval nuclear-powered ships have not caused a measurable increase in the general background radioactivity of the environment. Low-level cobalt-60 radioactivity is detectable in localized areas of harbor bottom sediment around a few piers at operating bases and shipyards where maintenance and overhaul of Naval nuclear-powered ships have been conducted over a period of several years. (Knapp-USGS)
W71-00030

DEEP-WELL INJECTION (LITERATURE REVIEW),
Water Pollution Control Federation, Washington, D.C.
T. J. Tofflemire.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 1231-1235, June 1970. 35 ref.

Descriptors: *Industrial wastes, *Deep-wells, *Injection wells, Wells, Waste water treatment, Waste disposal, Geology.

The use of deep wells for disposal of industrial waste has grown rapidly over the last 20 years. In

1950 there were many salt-brine disposal wells but only a few disposal wells for industrial wastes. In 1967 there were 40,000 salt-brine disposal wells and 110 wells for other wastes. It is suggested that in some cases deep-well injection has achieved a complete solution to the pollution problem and 100% BOD removal. A discussion of the legal implications, legislation and regulations of deep-well injection is discussed. Geological considerations are discussed from the standpoint of isolating the waste from fresh groundwater and from other natural resources such as gas, oil and coal. Abandoned wells, faults, and geological conditions must be considered when planning a disposal well site. It is also necessary to consider earthquake activity when planning a deep-well. It is conceivable that under certain conditions an improperly located deep-well might trigger an earthquake. Technical considerations such as operational problems from clogging and corrsion are mentioned. Numerous case histories are discussed from several industries which utilize deep-well injection disposal methods. (Hancuff-Texas)
W71-00136

CITY OF NEW BRUNSWICK V BOROUGH OF MILLTOWN (MUNICIPAL DISPOSAL OF WASTES).
For primary bibliographic entry see Field 06E.
W71-00328

FEEDING VALUE OF CATTLE MANURE FOR CATTLE,
Auburn Univ., Ala. Dept. of Animal Science.
W. Brady Anthony.
Journal of Animal Science, Vol 30, No 2, p 274-277, 1970. 6 tab, 14 ref.

Descriptors: *Farm wastes, *Manure, Cattle, Feeds, Reuse.
Identifiers: *Cattle manure, Manure feeding, Manure utilization, Feed supplement.

The objectives were to reappraise the feeding of manure-containing rations to fattening cattle and determine if cooking the manure improved it's feeding value. Rations containing wet cattle manure were readily consumed by fattening steers and these rations supported gain essentially equal to comparable cattle fed feeds without manure. Cooking or washing manure before mixing it with concentrate for feeding did not improve its feeding value. Carcass data were similar for manure-fed and other cattle. Wet manure collected daily per yearling steer was about 13.5 kg. (3.12 kg. dry matter) and about 6.6 kg. (1.52 kg. dry matter) was consumed daily. The digestibility data do not clearly indicate effective use of either manure energy or manure crude protein. However the data show that manure did not impair digestibility and actually saved concentrate dry matter used per unit of gain. This indirect evidence strongly suggests that manure was utilized to an appreciable degree for productive purposes. Feeding manure with concentrate did not completely alleviate waste disposal problems. Only about one-half of the manure collected daily was fed. The remainder of the daily excretion had to be disposed of elsewhere. (Miner-Iowa State)
W71-00329

EFFECTS OF SAN DIEGO'S WASTE WATER DISCHARGE ON THE OCEAN ENVIRONMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 05C.
W71-00347

DEEP-SEA DISPOSAL OF LIQUID AND SOLID WASTES,
Dillingham Environmental Co., Honolulu, Hawaii.
David D. Smith, and Robert P. Brown.
Industrial Water Engineering, Vol 7, No 9, p 20-24, September 1970. 5 p, 1 fig, 1 tab, 5 ref.

Descriptors: *Waste disposal, *Industrial wastes, *Solid wastes, *Radioactive waste disposal, *Oceans, Sludge disposal, Poisons, Explosives, Acids.
Identifiers: Waste disposal sites (Oceans).

The current status of oceanic disposal of liquid and solid wastes from 20 U.S. cities is summarized. In 1968, 48 million tons were disposed of at sea at an estimated cost of $29 million. About 120 disposal areas were identified. (Knapp-USGS)
W71-00349

MARINE DISPOSAL OF PETROLEUM REFINERY EFFLUENTS,
B. F. Steere.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 9 p, 7 fig, 5 ref.

Descriptors: *Oil wastes, *Oily water, *Disposal, *Sea water, Ocean currents, Surge tank, Retention, Industrial wastes.
Identifiers: South Africa, Oil separator.

Following the erection of an oil refinery on the South African coast, a system was designed for effluent treatment and disposal. Oily effluent water was passed through an oil separator with surge and retention basins, and then discharged by pipeline into the bay, at least 1,500 feet beyond the high water mark. A diffuser at the end of the line was to ensure adequate dispersion and dilution of the effluent with sea water and also prevent filting of the orifices. The design and operation of the system has proven successful. The system is capable of reducing undesirable constituents in the effluent, and of dispensing it in the sea, to the extent that little or no effect is noticeable on the environment. No complaints have been received from the public. (Selby-Texas)
W71-00423

PRELIMINARY REPORT ON GEOHYDROLOGIC EXPLORATION FOR DEEP WELL DISPOSAL OF EFFLUENT, WAIMANALO SEWAGE TREATMENT PLANT, OAHU,
Hawaii State Dept. of Land and Natural Resources, Honolulu. Div. of Water and Land Development.
Daniel Lum.
Department of the Land and Natural Resources, Circular C 54. 14 p, 6 fig, 1 tab.

Descriptors: *Effluents, *Sewage disposal, *Deep wells, Hydrology, Costs, Injection, Discharge measurement, Hawaii, Hydrogeology, *Exploration.

Because of a high estimated cost of constructing an ocean outfall sewage effluent disposal system, the Hawaiian Department of Land and Natural Resources decided to investigate effluent disposal utilizing deep wells. The various geohydrologic investigations were completed over a three-year period in three phases. First, a preliminary injection test utilizing an existing non-used well. Second, subsurface geohydrologic exploration consisting of drilling, coring, and testing eight Nx-size test holes. Depths varied from 50 to 450 feet and a total of 2,200 feet of core drilling and hydrologic testing were accomplished. Third, drilling and testing of three-15 inch diameter disposal wells within the sewage treatment plant site. Test results show that the three 15-inch disposal wells have a minimum capacity of 14.0 MGD (million gallons per day), compared to the present 1.1 MGD and the ultimate 2.2 MGD EFFLUENT FLOW DESIGNED FOR THE Waimanalo sewage treatment plant. Also, the 14.0 MGD capacity of the wells is twice the 7.0 MGD design peak flow of the treatment plant. (Selby-Texas)
W71-00430

WATER AND WASTE MANAGEMENT IN THE CAPE TOWN METROPOLITAN AREA,
For primary bibliographic entry see Field 05D.
W71-00431

5F. Water Treatment and Quality Alteration

HYDROBIOLOGICAL PROPSPECTIVES OF THE MEURTHE: MINERAL POLLUTION AND ALGAL VEGETATIONS (IN FRENCH),
Laboratoire de Biologie Vegetale, Nancy (France).
Jean-Francois Pierre.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 17, Serie D, p 2101-2102, 1970. 3 ref.

Descriptors: *Water treatment, *Chlorination, *Algal control, Rivers, Water pollution effects, Algae, Diatoms.
Identifiers: Rhine-Maas Basin (France), Meurthe River (France), Cladophora, Phormidium, Oscillatoria, Oedogonium.

One of the flowing cultures contained water of the River Meurthe with chlorine ion concentration in the proximity of 37 milligram/liter. In another culture the concentration of chlorine was increased to 760 milligram/liter. Inocula included Cladophora glomerata, Oedogonium spp, Phormidium tenue, Oscillatoria spp, and numerous diatoms. The increased concentration of chlorine failed to influence significantly the algal population thus demonstrating considerable ecological plasticity of these organisms. The results suggested that the concentration of 800 milligram/liter of chlorine ions in the River Meurthe would not produce a harmful suppression of algal growth. (Wilde-Wisconsin)
W71-00099

BEVERLY HILLS WATER DEPARTMENT SOLVES ALGAE PROBLEM WITH KMnO-sub-4,
Beverly Hills Municipal Water Dept., Calif.
Mary Jo Witt.
Water and Sewage Works, Vol 115, p 400-403, 1968. 2 fig, 6 photos.

Descriptors: *Potable water, *Water quality control, *Algae, Copper sulfate, Chlorine, Wells, California.
Identifiers: *Potassium permanganate, Beverly Hills (Calif).

Beverly Hills (California) operates two lime softening and filtration plants for their well water. Plants No 1 and No 2 treat an average of 5.5 mgd and 2.5 mgd, respectively. In March 1963, a 900,000 gal sedimentation basin in Plant No 1 was replaced by a 250,000 gal basin. Copper sulfate and chlorine had controlled algae and bacterial growths in the old basin but converted algae and bacteria to a greenish-black tar-like scum in the new basin. In July 1964, a 1.8 milligram/liter dose of potassium permanganate was added to the basin along with chlorine and copper sulfate resulting in noticeable improvement within a day or so; continued treatment eliminated the growth. For maximum contact, potassium permanganate was fed into the pump discharge line at the furthest well. Since starting potassium permanganate treatment, copper sulfate application was eliminated; shutdowns for clean-out are necessary only every 9-12 months, and there is practically no algae in the settling basin. During the summer and fall large pieces of algae would break loose from the clarifier and basin walls in Plant No 2. In October 1965, a 1.2-1.5 milligram/liter continuing dose of potassium permanganate, fed to the well farthest from the plant, freed the growth from the basin walls. (Haskings-Wisconsin)
W71-00110

DIATOMITE FILTRATION SLUDGE DISPOSAL (SUBCOMMITTEE PROGRESS REPORT),
American Water Works Association, New York. Water Quality Div.
E. R. Baumann, J. Stewart Brown, and Charles H. Lawrence.
Journal of the American Water Works Association, Vol 62, No 8, p 507-509. 1 tab.

escriptors: *Sludge, *Waster treatment, *Filtra-on, *Diatonacious earth, Lagoons, Dewatering ewage disposal, Chemicals.
dentifiers: Solids, Reuse, Land disposal.

here is even less published information on prac-ces with disposal of diatomite filtration plant astes than with conventional filtration plant rocess wastes. For filtration wastes the chief vailable experience has been with settling lagoons hich have been more or less for diatomite treat-ent plants. It is hoped that the plant survey cur-ntly being conducted will reveal additional infor-ation about existing plants. It is hoped that ssistance will be available from other organiza-ons. In general it appears that the overall mag-itude of the problems for disposal of process astes from water filtration by diatomite and by onventional facilities are quite close. Each has its wn inherent advantages and disadvantages. iatomite filtration involved substantially less total olumn of liquid waste than does conventional. For w turbidity applications which are those normally hosen for diatomite treatment the total dry solids asted may not be much greater, if at all, than that roduced by coagulation sludge from a conven-onal filtration plant of the same through put. The orosity of diatomite wastes make for relatively asy dewatering, however, the abbrasive nature of he filter aid may make handling difficult. (Han-uff-Texas)
V71-00125

IIGH-RATE FILTER EFFICIENCY,
Contra Costa County Waste District, Calif.
V. Leslie Harris.
ournal of the American Water Works Association, Vol 62, No 8, p 515-519, August 1970. 2 fig, 2 tab, ref.

Descriptors: *Filtration, *Water treatment, Operations, Filters, Water quality, Head-loss.
dentifiers: Loading, Backwash, Conditioning.

An experimental programme made prior to the onstruction of a new water treatment plant for the Contra Costa County District indicated that the easibility of upping the capacity of filtration some 0% from 6 to 10 gpm/sq ft while applying a water f higher turbidity to the filters. When the plant as constructed in May 1968 it demonstrated an fficiency three times that of the former main plant ith dual media filters and nearly 8 times the effi-iency of the same plant back in the days of straight and filtration. In the course of more than 400 runs ith an experimental filter it was found that a con-itioned filter accepted surges without passage of reviously deposited material. A filter may be con-itioned to augment straining through the addition f small amounts of a polymer to the backwash ater during the backflow time. Conditioning was eveloped using anthracite sand filters which also nabled longer runs at higher rates. Experimental ork also indicated that a substantial air lift in-roduced just above the expanded bed removed ines which otherwise remained above the lifted ed. Garnet, a fine heavy material, was eliminated ecause of some hazard of its downward migration o the supporting gravel and its tendency to result n the fountain effect when localized high flows oc-curred. (Hancuff-Texas)
W71-00129

WATER AND HEALTH--ARE WE CONCERNED ENOUGH,
Pennsylvania Dept. of Health, Harrisburg. Div. of Sanitary Engineering.
Walter A. Lyon.
In: Water Resources Bulletin, Vol 6, No 1, Februa-ry 1970, p 72-77. 12 ref.

Descriptors: *Water quality control, *Public health, *Water pollution, *Water pollution sources, Pesticide residues, Viruses, Chemicals, Legal aspects, Public rights, Social aspects, En-vironmental effects, Attitudes.
Identifiers: *Environmental policy.

From an historical point of view, man's concern about the health and protection of water supply is the history of the dramatic reduction in acute communicable diseases due to water-borne micro-organisms. Now that these have been essentially eliminated, there has been a great reduction in concern by scientists and the medical profession with the health aspects of contaminated water. This, in spite of the fact that many concerned people and national advisory groups have reminded us that an increasing number of possible chemical and other hazards find their way into our water supplies and expose human populations to contaminants at low concentration levels without reliable knowledge as to their health effects. Too little research is being done on the health effects of chemicals, pesticides, and viruses. The fact that large populations are being exposed to these possible hazards raises legal and public policy questions. Persons who are largely ignorant of the possible harm of these substances are being exposed to them without consent. Often low level exposure to environmental contaminants is not known or not discovered until considerable time has passed. This raises the question concerning the burden which should be imposed on industry and others who introduce new substances in the environment. The best approach in solving this problem is to prohibit the new substance from being introduced into the environment until it has been shown by reliable studies that even low level exposure is not likely to harm human health. (Marriott-Chicago)
W71-00312

WATER AND SEWER REPORT.
Essex County Planning Board, Belleville, N.J.
For primary bibliographic entry see Field 05D.
W71-00420

PRELIMINARY REGIONAL PLAN FOR WATER AND SEWERAGE FACILITIES.
East-West Gateway Coordinating Council, East St. Louis, Ill.
For primary bibliographic entry see Field 05D.
W71-00421

WATER AND WASTE MANAGEMENT IN THE CAPE TOWN METROPOLITAN AREA,
For primary bibliographic entry see Field 05D.
W71-00431

RAPID PROCEDURES TO MONITOR WATER FOR POTABILITY,
Aerospace Medical Research Lab., Wright-Patterson AFB, Ohio.
For primary bibliographic entry see Field 05A.
W71-00455

5G. Water Quality Control

CLEAN WATER FOR THE 1970'S--A STATUS REPORT.
Federal Water Quality Administration, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $1.50. Federal Water Quality Administration Status Report, June 1970. 80 p.

Descriptors: *Water pollution control, *Water quality control, *Water quality act, Legislation, Water law, Quality control, Abatement, Governments, Water quality.
Identifiers: Federal Water Quality Administration.

Since 1966, the primary responsibility for carrying out the Federal programs in water pollution has rested with the Federal Water Pollution Control Administration. Passage of the Water Quality Improvement Act of 1970 resulted in a new name for the agency, the Federal Water Quality Administration (FWQA), which stresses the more positive aspects of the program. The purpose of this first annual progress report is to provide a groundwork for understanding the nature of the Federal and State water pollution control programs, to detail the progress which has been made during the first year of the Nixon Administration, and to assess the measures which will be required to fulfill the challenge of the 1970's. An important part of this assessment is the impact of significant new water pollution control legislation. (Knapp-USGS)
W71-00011

DISPOSAL OF RADIOACTIVE WASTES FROM U. S. NAVAL NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES, 1969,
Naval Ship Systems Command, Washington, D.C.
For primary bibliographic entry see Field 05E.
W71-00030

POOVEY V CITY OF HICKORY (CITY'S LIABILITY FOR WATER POLLUTION RESULTING FROM SEWAGE DISPOSAL).
For primary bibliographic entry see Field 06E.
W71-00162

A STUDY OF THE DISPERSION AND FLUSHING OF WATER-BORNE MATERIALS IN THE NORTHWEST BRANCH OF BALTIMORE HARBOR, AND THE RELATIONSHIP BETWEEN THESE PHYSICAL PROCESSES AND THE WATER QUALITY OF THE INNER HARBOR,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 05B.
W71-00200

EXTENT OF BRACKISH WATER IN THE TIDAL RIVERS OF MARYLAND,
Geological Survey, Towson,Md.
For primary bibliographic entry see Field 02L.
W71-00215

THE ROLE OF HIGHER WATER PLANTS IN THE SELF-PURIFICATION OF OIL-POLLUTED RIVERS,
Northern Research Inst. of Hydraulic Engineering and Reclamation, Kazan (USSR). Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 05B.
W71-00223

WATER SUPPLY AND WATER POLLUTION CONTROL-APPENDIX D TO REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio. Ohio Basin Region.

Report on Development of Water Resources in Appalachia published in 25 Volumes. Federal Water Pollution Control Administration Report, Vol 19 of 25 Vol, Append D, March 1969. 379 p.

Descriptors: *Water supply, *Water pollution control, *Water resources development, *Appalachian Mountain region, Water pollution sources, Water pollution treatment, Waste water disposal, Industrial wastes, Acid mine water, Water utilization, Surface waters, Groundwater.
Identifiers: Appalachian redevelopment.

Appendix D, 'Water Supply and Water Pollution Control' of the Report for Development of Water Resources in Appalachia furnishes information on water supply and water pollution control needs in and adjacent to the Appalachian region. Included are a general appraisal of present and future water supply and water pollution control needs, and the ways and means of satisfying these needs. The appendix also includes detailed discussions of water supply and water quality control needs that can be satisfied from selected reservoir projects that are proposed for inclusion in the Appalachian Plan for

Water Resources Development. An index for the entire report with its 9 appendices is included. (Knapp-USGS)
W71-00225

EFFECT OF SOIL WATER STRESS AND SOIL TEMPERATURE ON TRANSLOCATION OF DIURON,
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 02I.
W71-00226

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
For primary bibliographic entry see Field 05B.
W71-00231

MANAGING WASTE HEAT WITH THE WATER COOLING TOWER,
Marley Co., Kansas City, Mo.
For primary bibliographic entry see Field 05D.
W71-00232

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
For primary bibliographic entry see Field 05B.
W71-00236

HAMPTON V NORTH CAROLINA PULP CO (PRIVATE REMEDY FOR POLLUTION).
For primary bibliographic entry see Field 06E.
W71-00243

ALLOWABLE THERMAL POLLUTION LIMITS - A PHYSICOCHEMICAL APPROACH,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 05C.
W71-00250

SOME OBSERVATION OF STREAMFLOW AND WATER QUALITY IN THE URBAN ENVIRONMENT,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 04C.
W71-00318

FEEDING VALUE OF CATTLE MANURE FOR CATTLE,
Auburn Univ., Ala. Dept. of Animal Science.
For primary bibliographic entry see Field 05E.
W71-00329

THE FUTURE OF FARM ANIMAL WASTE MANAGEMENT,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
James A. Moore, and Donald B. Brooker.
Agricultural Engineering, Vol 51, No 7, p 414, 417, July 1970.

Descriptors: *Farm waste, *Water treatment, *Water pollution control, *Long term planning, Manure, Odor, Agricultural engineering.

Predicts the future development of livestock waste management schemes. It includes a discussion of future water quality requirements as well as the necessity for odor control. The need for mechanization as well as increased energy consumption are discussed. (Miner-Iowa State)
W71-00331

LIVESTOCK WASTE MANAGEMENT STUDIES-TERMINATION REPORT,
Illinois Univ., Urbana. Agricultural Experiment Station.
For primary bibliographic entry see Field 05D.
W71-00342

STEAM INJECTION, OIL RECOVERY TECHNIQUES, AND WATER QUALITY,
Orange County Water Pollution Control Dept., Santa Ana, Calif.; and Orange County Flood Control District, Santa Ana, Calif.
J. C. Roberts, and J. W. Williams.
Journal of the Water Pollution Control Federation, Vol 42, No 8, Part 1, p 1437-1445, August 1970. 9 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Oil fields, *Injection wells, *Secondary recovery (Oil), *Steam, *Water quality, Water pollution effects, Water pollution sources, Flooding, Injection, Oil reservoirs, Groundwater.
Identifiers: Well tests, Steam injection.

Steam is injected into oil wells to decrease oil viscosity and improve production rates and ultimate recovery. The effect of steam injection on oil zone waters is not well known. A survey of steaming practices in the Yorba Linda Field in California was made. Extensive tests were run on a number of parameters for a shallow-zone well, and it was concluded that the water being produced was representative of the groundwater in that zone. Except for silica concentration, steaming does not seem to affect water quality in the shallow zone of the Yorba Linda Field. (Knapp-USGS)
W71-00371

PHYSICAL DATA OF POTOMAC RIVER TIDAL SYSTEM INCLUDING MATHEMATICAL MODEL SEGMENTATION,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
Norbert A. Jaworski, and Leo J. Clark.
Chesapeake Technical Support Laboratory Technical Report No 43, Federal Water Pollution Control Administration, 1970. 49 p, 9 fig, 15 tab.

Descriptors: *Estuaries, *Data collections, *Hydrologic data, *Water pollution sources, *Virginia, Maryland, District of Columbia, Tides, Channel morphology, Model studies, Streamflow, Mathematical models, Depth, Cross-sections, Profiles.
Identifiers: Potomac Estuary.

In water quality studies of the Potomac, the Chesapeake Technical Support Laboratory (CTSL) collected data on the physical characteristics of the estuary. Factors of major importance are: surface and cross-sectional areas, volumes, and distances between bridges, buoys, prominant landmarks and other reference points. This is not only essential for mathematical modeling studies but also to interpret field survey information. The tidal portion is several hundred feet in width at its head at Washington and broadens to nearly six miles at its mouth. A shipping channel with a minimum depth of 24 feet is maintained upstream to Washington. Except for this channel and a few short reaches where depths up to 100 feet can be found, the tidal portion is relatively shallow with an average depth of about 18 feet. The mean tidal range is about 2.9 feet in the upper portion near Washington and about 1.4 feet near the Chesapeake Bay. The lag time for the tidal phase between Washington and the Chesapeake Bay is about 6.5 hours. Effluents from twelve major waste water treatment plants, with a thirteenth under construction, serving a population of about 2,500,000, are discharged into the upper tidal system. The locations of the discharges from these treatment facilities are shown. (Knapp-USGS)
W71-00375

THE BENEFICIAL USE OF STORM WATER, FINAL REPORT, A SYSTEM STUDY, DESIGN, AND EVALUATION OF THE LOCAL STORAGE, TREATMENT, AND REUSE OF STORM WATER.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 05D.
W71-00409

TREATMENT OF WASTE EATER - WASTE OIL MIXTURES.
Armco Steel Corp., Middletown, Ohio.
For primary bibliographic entry see Field 05D.
W71-00410

WATER AND SEWERAGE STUDY, SECOND PHASE.
Morris County Planning Board, Morristown, N.J.

Available from NTIS as PB-193 081, $3.00 in paper copy, $0.95 in microfiche. Elson T. Killam Assoc., Millburn, N.J. May 1970. 74 p.
Identifiers: *Urban planning, *New Jersey, *Water supplies, Urban planning, *Sanitary engineering, Urban planning, Water pollution, Control, Drainage, Water resources, Groundwater, *Sewers, *Regional planning and development, *Waste treatment, *Waste treatment facilities, *Watersheds, *Morris County (New Jersey).

At the present time practically all the Public Water Purveyors within the County derive their water supply from wells, with the greatest concentration of use being in the Central and Eastern portions of the County. Other water supply sources will be required, necessitating the development of surface supplies. The supplies and transmission facilities being developed by the Morris County Municipal Utilities Authority are discussed. Adequate sewerage facilities and treatment facilities needed in the future are discussed.
W71-00435

A MASTER SEWERAGE PLAN FOR UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.

Elson T. Killam Assoc. Millburn, N.J., April 1970. 83 p.
Identifiers: *Roads, Sand, *Structures, Drainage, Interactions, Shear stresses, Pipes, Deflection, Compressive properties, Strain (Mechanics), Flexible structures, Mathematical models, Ohio, *Culverts, Soil stabilization.

The report presents a Master Sewage Plan for Union County, New Jersey. It includes the analysis of existing facilities, as presented in the First Stage Report, entitled, 'Sanitary Sewerage Facilities in Union County'. This report analyzes by comparing their capacity to present and projected sewage flows and the New Jersey State Department of Health Standards.
W71-00436

RICHMOND REGIONAL SEWERAGE PLAN AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT.
Richmond Regional Planning District Commission, Va.

Available from NTIS as PB-192 437, $3.00 in paper copy, $0.95 in microfiche. McGaughy, Marshall and McMillan, April 1970. 57 p.
Identifiers: *Urban areas, Sewage, *Sewage, *Management planning, Sanitary engineering, Disposal, Volume, Pipes, Fluid flow, Virginia, *Regional planning, Development, Richmond (Virginia), Sewage treatment.

The Sewage Plan is an areawide plan for long range development of sewage systems. The Plan provides for coordination and cooperation between political subdivisions and private firms involved in fulfilling the present and future sewer requirements for the area: The basic framework is included for: Waste water collection and treatment systems; The areas

to be served and the general capacities and requirements of the system. The plan provides for the development of a unified coordinated system capable of providing for future growth of the regional population while considering economic forecasts and land use plans. (See also W71-00446)
W71-00445

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.

Available from NTIS as PB-192 442, $3.00 in paper copy, $0.95 in microfiche. McGaughy, Marshall and McMillan, April 1970. 76 p.
Identifiers: *Urban areas, Water supplies, *Management planning, Data, Volume, Sources, Civil engineering, Virginia, *Regional planning, Development, Richmond (Virginia), Water consumption, Water services.

The volume consists of tabulated water demands by demanded zones and other supplementary technical data pertinent to the basic report. (See also W71-00445)
W71-00446

WATER AND SEWER FACILITIES PLAN: VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.

Available from NTIS as PB-190 865, $3.00 in paper copy, $0.95 in microfiche. Clark, Dietz and Associates, March 1970. 46 p.
Identifiers: *Water supplies, *Florida, *Sanitary engineering, Urban planning, Sewage, Wastes, Water pollution, Control, Management planning, Maps, Tables, *Volusia County (Florida), Water treatment, Regional planning.

The principal purpose of this study is to recognize the magnitude of the problems of supplying water and collecting, treating and disposing of human wastes from the urban areas of the county through the year 2000, and to develop a long-range concept and general plan demonstrating how these problems should be solved.
W71-00450

STORM DRAINAGE IN THE TOLEDO REGIONAL AREA.
Toledo Regional Area Plan for Action, Ohio.
For primary bibliographic entry see Field 04A.
W71-00454

WATER AND SEWER PLAN FOR THE TUSCALOOSA METROPLITAN AREA.
Tuscaloosa Area Council of Local Governments, Ala.

Available from NTIS as PB-191 340, $3.00 in paper copy, $0.95 in microfiche. Rust Engineering Co., Birmingham, May 1969. 56 p.
Identifiers: *Urban planning, *Alabama, *Water supplies, *Sanitary engineering, Urban areas, Population, Costs, Construction, Management planning, Area planning, Development, *Tuscaloosa (Alabama).

Contents: Population of Tuscaloosa County; Physical features and natural resources; Existing water and sewer facilities in Tuscaloosa County; Future water improvements; Future sewerage improvements; and Costs of water and sewer improvements.
W71-00459

FACTORS IN TECHNOLOGY TRANSFER: THE CASE OF CORNING PYREX ACID-WASTE DRAINLINE,
Syracuse Univ., N.Y.
E. B. Fredrikson, and E. W. Lawson.

Available fron NTIS as N70-21116, $3.00 in paper copy, $0.95 in microfiche. Occasional Paper No. 1, July 1969. 15 p.
Identifiers: *Borosilicate, Technology utilization, Budgeting, Industry, Manufacturing, Transfer functions.

A technology transfer analysis is presented, consisting of two major factors: (1) a combination of tedious development work, an imaginative individual, and luck; and (2) a well planned marketing program. The case of the chemical and heat resistant acid waste drainline is used as an example. The development process, choice of materials, subsequent product improvements, and marketing of the drainline are described.
W71-00460

WATER QUALITY CRITERIA FOR SELECTED RECREATION USES,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 06B.
W71-00471

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS, PRIMARY TREATMENT OF STORM WATER OVERFLOW FROM COMBINED SEWERS BY HIGH-RATE, FINE-MESH SCREENS.
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
For primary bibliographic entry see Field 05D.
W71-00476

ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA,
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
Wendle R. Snapp, and Robert A. Lemon.
Available from NTIS as PB-195 201, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $2.00, I 67.13/4: 11024 DMS 05/70. Water Pollution Control Research Series - 11024 DMS 05/70 May 1970. 250 p, 60 tab, 101 fig, 10 plates, 21 ref. FWQA Program 11024DMS, Contract No. 14-12-200.

Descriptors: *Sewers, *Infiltration, *Overflow, *Water pollution control, Surveys Computer programs, Storm runoff, Flow measurement, Sewers, Rainfall-runoff relationships, Sampling, Construction costs.
Identifiers: Sewer infiltration, Sanitary sewers.

Results are given of investigations, on 25 percent of Roanoke, Virginia's separate sanitary sewerage system, on the amounts of infiltration for various storm intensities and durations and the amounts of sewage overflow from the system, From these results the system was analyzed, using an in-house developed computer program, to assess the magnitudes and frequencies of overflows. The generated data from the analysis were used to develop an optimum design for remedial measures to reduce sewer overflows. Costs estimates are presented for the various items of work involved.
W71-00478

PROPOSED COMBINED SEWER CONTROL BY ELECTRODE POTENTIAL.
Merrimack Coll., North Andover, Mass.

Available from NTIS as PB-195 169, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series 11024 DOK 02/70, Feb. 1970. 69 p, 10 tab, 20 fig, 38 ref. FWQA Project 11024 DOK, Contract No. 217-01-68.

Descriptors: *Electrodes, *Flow control, *Flow rates, Sewage, Outlets, Water pollution control, Overflow, Dissolved oxygen, Pollution abatement, Storm runoff.
Identifiers: *Combined sewers, *Electrode potential, *Sewage overflows, Sewer outfalls.

The effectiveness was investigated of electrode potential measurements to modulate discharges from comvined and storm sewer overflows to reduce stream and estuarine pollution. Studies included varying the composition of sewage, flow rate and examining the tendency to polarize or coat the electrodes under actual flow conditions. The analysis of experimental results shows a high degree of correlation between the electrode potential of the sewage and its strength. Linear correlation coefficients between electrode potential were determined for BOD, COD, Sulfides, total phosphorus, nitrates, and chlorides. It was demonstrated that the potential will be more negative the greater the S— concentration, except when a small amount of DO is present which exerts an attenuating influence. Flows carrying substantial concentrations of reducing substances with a detrimental impact on the dissolved oxygen reservoir of any receiving waters must be kept from exerting their damaging influence on bathing beaches, tidal estuaries and other water resources. Controlling the flow from outfalls by the electrode potential should significantly help to minimize such insults to the environment.
W71-00479

LEGAL ASPECTS OF WATER STORAGE FOR FLOW AUGMENTATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William R. Walker, and William E. Cox.
Available from NTIS as PB-195 170, $3.00 in paper copy, $0.95 in microfiche. Also published as Virginia Water Resources Research Center Bulletin 37, 'Legal Aspects of Water Supply and Water Quality Storage'. Water Pollution Control Research Series 16090 FPW 03/70, August 1970. 235 p, 6 append. FWQA Contract WP-01087. FWQA Program 16090 FPW.

Descriptors: *Water rights, *Federal-State water rights conflicts, Federal jurisdiction, Riparian land, State jurisdiction, Water Law, *Water storage, Water Quality, *Flow augmentation, Legal aspects, Water pollution control, Low-flow augmentation.

Enabling legislation for storage of water in Federal reservoirs for supply purposes and quality control through low-flow augmentation includes the Water Supply Act of 1958, the Watershed Protection and Flood Prevention Act, and the 1961 Amendment to the Federal Water Pollution Control Act. The Flood Control Act of 1944 and the Federal Water Power Act also have possible applicability. The enabling legislation and other law defining the operating procedure of the federal water resource agencies make water supply and water quality storage somewhat dependent on the provisions of state water law. State law may affect the aquisition of water rights for storage and the procedure whereby it is applied to its intended functions. The impact of state law on the aquisition process varies according to whether water rights are aquired by the United States or by a private party. When private interests are responsible, as in the case of water supply storage in Corps of Engineers and Soil Conservation Service facilities, the aquisition of rights is not as complex as when a Soverign is involved. Aquisition of water rights by the federal government gives rise to federal-state jurisdictional problems and several unresolved questions concerning water rights. State law also affects the use of a natural channel as a conduit because it defines the rights of others to use this water after it is released from storage. A liberal policy of permitting others to use the stored water would have the potential effect of diminishing the benefits to the water supply or water quality storer. (Johnson-Virginia Polytechnic Institute)
W71-00480

JOHN B KELLY, INC V LEHIGH NAV COAL CO (POLLUTION OF RIVER BY COAL MINING INDUSTRY).
For primary bibliographic entry see Field 06E.
W71-00505

TICHENOR V HARBISON (DISCHARGE OF OIL WELL OVERFLOW INTO NATURAL WATERCOURSES).
For primary bibliographic entry see Field 06E.
W71-00514

WATKINS V PEPPERTON COTTON MILLS (PRESCRIPTIVE RIGHT TO DUMP SEWAGE).
For primary bibliographic entry see Field 06E.
W71-00528

GREEN V PELICAN NATURAL GAS CO (DAMAGES FROM OIL WASTES).
For primary bibliographic entry see Field 06E.
W71-00530

CHAPMAN V AMERICAN CREOSOTING CO (LIABILITY FOR POLLUTION OF WELLS AND SPRINGS).
For primary bibliographic entry see Field 06E.
W71-00538

LATONIA REFINING CORP V DUSING (OIL REFINERY LIABLE FOR STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W71-00540

HUNZE V CITY OF CAPE GIRARDEAU (LIABILITY FOR STREAM POLLUTION BY MUNICIPALITY).
For primary bibliographic entry see Field 06E.
W71-00542

SHELLEY V OZARK PIPELINE CORP (CHARACTERIZATION OF OIL PIPELINE LEAK AS TEMPORARY OR PERMANENT NUISANCE).
For primary bibliographic entry see Field 06E.
W71-00543

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

FREQUENCY OF DESIGN DROUGHT,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 04A.
W71-00025

THE USE OF ANALOG AND DIGITAL COMPUTERS IN HYDROLOGY.
International Association of Scientific Hydrology, Gentbrugge (Belgium); and United Nations Educational, Scientific and Cultural Organization, Louvain (Belgium).

Proceedings of the Tucson Symposium, International Association of Scientific Hydrology and Unesco, Vol I and II, 1969. 755 p.

Descriptors: *Analog computers, *Digital computers, *Hydrology, *Mathematical models, *Groundwater, *Surface waters, *Application methods.
Identifiers: Hybrid computers.

In order to bring together the analog and digital specialists and the practising hydrologists and to give each an opportunity to become acquainted with the other's views and problems, the Coordinating Council for the International Hydrological Decade organized a Symposium at Tucson, Arizona in cooperation with the International Association of Scientific Hydrology, Unesco, the American Geophysical Union, the United States National Committee for the International Hydrological Decade and the University of Arizona. This joint publication by the International Association of Scientific Hydrology and Unesco of the papers presented at the Symposium considered the following aspects: (1) Analogue Computing Techniques; (2) Digital Computing Techniques; (3) Digital Data Handling Techniques; (4) Hybrid Computing Techniques; (5) Comparative Studies of Computing Techniques; and (6) Mathematics of Computing Techniques. Some papers (Groups 5 and 6) discussed the general theoretical and philosophical aspects of modelling and computers, but most of them described applications (three first groups). The papers of the first series were mostly in relation with problems on groundwater but some of them considered more specific problems such as the influence of man. In the second group, papers were mostly in relation with problems on surface waters: floods, runoff, precipitation, water quality, etc. The different fields of hydrology were represented in the third group. (See also W71-00072 through W71-00095) (Kriss-Cornell)
W71-00071

WATERSHED SIMULATION BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02A.
W71-00072

CALIFORNIA'S DIGITAL COMPUTER APPROACH TO GROUNDWATER BASIN MANAGEMENT STUDIES,
California Dept. of Water Resources; and TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 04B.
W71-00073

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
Gary S. Risch.
The Use of Analog and Digital Computers in Hydrology, Vol I, p 268-279, 1968. 10 p, 2 fig, 5 tab.

Descriptors: *Optimization, *Dynamic programming, *Linear programming, *Economics, Reservoirs, Cost, Hydrology, California.
Identifiers: Eel River Project, California.

Development of the Eel River, involving three potential reservoirs and a connecting tunnel, provided an opportunity for the use of linear and dynamic programming on a medium sized project. A computer model was formulated for both linear and dynamic programming solutions. The techniques aided the planner in analyzing hydrologic and economic problems and provided an optimum economic solution with less effort than expended using conventional methods. Because of increased computer time inherent in linear programming, dynamic programming was chosen for the part two sizing problem and linear programming was therefore used for the part one sizing problem. The object function was to minimize the system cost, given a required system yield. Dynamic programming maximized overall efficiency. For the Eel River problem, three reservoirs comprised three stages and the various values of firm water yield for each stage was considered by the states. Using a trial and error optimization method, every possible sequence of interrelated decisions was explored, (See also W71-00071) (Kriss-Cornell)
W71-00077

SOME PROBLEMS OF STREAMFLOW FORECASTS BASED ON INFORMATION THEORY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-00078

APPLICATION OF STREAMFLOW SYNTHESIS AND RESERVOIR REGULATION - 'SSARR' PROGRAM TO THE LOWER MEKONG RIVER,
For primary bibliographic entry see Field 04A.
W71-00080

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 04A.
W71-00088

INTERPRETATION OF HYDROGEOLOGIC DATA FOR GROUNDWATER MANAGEMENT,
Geological Survey, Denver, Colo., and Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-00150

OPTIMIZATION OF CONJUNCTIVE USE OF WATER IN A STREAM-AQUIFER SYSTEM, USING LINEAR PROGRAMMING,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00182

MULTIRESERVOIR OPERATION STUDIES,
Arizona Univ., Tuscon; and Network Analysis Corp., Port Washington, N.Y.
Theodore G. Roefs, and Lawrence D. Bodin.
Water Resources Research Vol 6, No 2, p 410-420, April 1970.

Descriptors: *Reservoir operation, *Stochastic processes, *Streamflow, Optimization, Mathematical studies, Computers, Computer program, Risks, Decision-making, Storage, Hydroelectric power, Model studies, Probability, Inflow, Discharge, Dynamic programming, Flood control, Costs.
Identifiers: Multireservoir studies, Dantzig-Wolfe.

The determination of a reservoir operation rule has been treated as a 'worst case' deterministic problem. This has been severely criticized but at present there is a dearth of valid alternative methods. An implicit stochastic process is compared to possible alternative analytical processes. This process refers to a sequence of steps consisting of streamflow synthesis, deterministic optimization, and multivariate analysis of deterministic optimization results. Some formulations based on the method of Dantzig-Wolfe decomposition are shown to be reasonably accurate presentations of a nonlinear multireservoir deterministic optimization problem. The authors analyze the procedures for the determination of an optimal operation problem in terms of the economic factors involved. They conclude that, although it would produce large cost savings in the operation of large multiple reservoir systems, the answer will necessitate technological development at substantial expense, this expense will make the operation economically unfeasible. (Murphy-Rutgers)
W71-00281

ECONOMETRICS AS PIONEERING IN NONEXPERIMENTAL MODEL BUILDING,
Uppsala Univ. (Sweden). Inst. of Statistics.
Herman O. Wold.
Econometrica Vol 37, No 3, p 369-381, July 1969.

Descriptors: *Economic research, *Operations research, *Mathematical studies, *Forecasting, Model studies, Economic evaluation, Prices, Demand, Regression analysis, Income, Social aspects, Planning, Research.
Identifiers: *Econometrics, *Operation analysis, Experimental models, Nonexperimental models, Unirelational models, Multirelational models.

Econometrics serves the purposes of operations analysis, thus involving a synthesis of experimental and nonexperimental model building. This paper

focuses on three aspects of econometric model building and operations analysis. The first is the gradual evolution in the construction of unirelational models and the succeeding rise in aspiration levels by building multirelational models. The second aspect is that of econometrics as a spearhead in the nonexperimental methods of model building. The third aspect deals with the lessons that can be drawn from econometrics to promote interdisciplinary developments of the social sciences. The widespread use of econometric methods in water resources research makes its evaluation in terms of the scientific evolution of interest to the water researcher. (Murphy-Rutgers)
W71-00288

A NOTE ON REGIONAL INPUT-OUTPUT MODELS,
South Carolina Univ., Columbia.
Teddy T. Su.
The Southern Economic Journal Vol XXXVI, No 3, p 325-327, January 1970.

Descriptors: *Input-output analysis, *Regional analysis, *Imports, Model studies, Economic evaluation, Labor, Capital, Industrial production, Technology, Demand, Income, Employment, Government, Investment, Taxes.
Identifiers: *National input-output, Input-coefficient matrix, Income multiplier, Employment multiplier.

Many water resource development projects are concerned with the overall economic development of the area in which they are located. This paper attempts to supplement traditional regional input-output models with a practical analytical tool based on the modified national input-output model. The author emphasizes the importance of imports from other regions and uses the national input coefficients only to reflect the technology of the normal production process. The article argues that values of income and employment multipliers in other regional input-output models based on national input coefficients are overestimated. Thus, any regional economic projections will appear to be too optimistic without accounting for the effects of imports into the region. These conclusions should lead to some changes in the method in which the water researcher attempts to determine the effect of, and future need for, water resource development. (Murphy-Rutgers)
W71-00295

THE SYMMETRIC FORMULATION OF THE SIMPLEX METHOD FOR QUADRATIC PROGRAMMING,
Calgary Univ. (Alberta); and Purdue Univ., Lafayette, Ind.
C. Van De Panne, and Andrew Whinston.
Econometrica Vol 37, No 3, p 507-527, July 1969.

Descriptors: *Mathematical studies, *Economic evaluation, *Programming, *Optimization, Model studies, Distribution patterns.
Identifiers: *Simplex method, *Quadratic programming, *Tableaux, Convergence, Symmetry, Symmetric variant, Parametric methods.

This article gives a reformulation of the simplex method for quadratic programming with the advantage of generating tableaux of certain symmetry properties. The quadratic programming problem is briefly stated, and the equations of the Kuhn-Tucker conditions are formulated. These equations are used to give the set-up tableau from which all other tableaux are derived. The symmetric variant of the simplex method for quadratic programming is then explained and, using the symmetric properties of the tableaux, explicit formulas for triangular tableaux are developed. The properties of the standard tableaux are derived and the relationships with other methods are studied. The potential use of quadratic programming in water resources research makes this article relevant to researchers interested in obtaining a basic understanding of the technique. (Murphy-Rutgers)
W71-00298

INVESTIGATING CAUSAL RELATIONSHIPS BY ECONOMETRIC MODELS AND CROSS-SPECTRAL METHODS,
Nottingham Univ. (England).
C. W. J. Granger.
Econometrica Vol 37, No 3, p 424-438, July 1969.

Descriptors: *Economic evaluation, *Model studies, *Mathematical studies, Statistics, Regression analysis, Correlation analysis, Fluctuation.
Identifiers: *Econometrics, *Feedback, Causality, Spectral methods, Causal lag.

The object of this paper is to discuss the relationships between certain classes of econometric models involving feedback and the functions arising in spectral analysis, particularly the cross-spectrum and the partial cross-spectrum. The paper demonstrates that in the two-variable case the feedback mechanism can be broken down into two causal relations and that the cross-spectrum can be considered as the sum of two cross-spectra, each closely connected with one of the causations. Measures of causal lag and causal strength can then be constructed. A generalization of this result with the partial cross-spectrum is then suggested. The potential use of spectral analysis in empirical analyses of water resources makes this article relevant to the water area. (Murphy-Rutgers)
W71-00299

COMMENT ON FACTOR ANALYSIS AND REGRESSION,
Chicago Univ., Ill.
Benjamin King.
Econometrica Vol 37, No 3, p 538-540, July 1969.

Descriptors: *Mathematical studies, *Statistical analysis, *Regression analysis, Model studies, Economic evaluation, Measurement, Least squares method, Random processes.
Identifiers: *Econometrics, *Multicolliniarity, *Factor analysis, Factor loading matrix.

This paper attempts to demonstrate that if one believes in an underlying factor analysis model involving fewer factors than there are variables, this is equivalent to the acceptance of an error in the variables model for which the parameters may be calculated directly from the factor loading matrix. However, difficulties arise if interest is in the coefficient interpreted as the marginal contribution of this variable to the dependent variable. The problem then becomes one of having more than one solution. The author also objects to the assumption of perfect multicollinearity among the true variables, as implied by the factor model. Cases of errors in the variables and high intercorrelation are frequent in econometric studies in water resources. Accordingly, this paper may provide useful methodology for empirical studies in the water area. (Murphy-Rutgers)
W71-00302

URBAN (MUNICIPAL) WATER MANAGEMENT,
Syracuse Univ., N.Y. Coll. of Forestry.
For primary bibliographic entry see Field 06B.
W71-00317

FLOOD PLAIN MODELING,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-00321

DYNAMIC PROGRAMMING FOR OPTIMUM CONJUNCTIVE USE,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W71-00323

A MUNICIPAL WATER DEMAND MODEL FOR THE CONTERMINOUS UNITED STATES,
Avco Economic Systems Corp., Washington, D.C.
Thomas R. Burke.
Water Resources Bulletin, Vol 6, No 4, p 661-681, July-Aug 1970. 2 fig, 7 tab.

Descriptors: *Municipal water, *Water demand, *Planning, *Model studies, Social aspects, Data collections, Regression analysis.
Identifiers: *Economic model, *Water resources planning, Initial effort.

With the increasing Federal role in all aspects of water resource planning, the need for a planning model to enable calculations of projected Municipal Water requirements has become evident. This study represents an initial effort at developing an economic model of Municipal Water requirements which (1) incorporates variables (or proxies) reflecting the various factors affecting water demand (i.e., demographic, social, industrial), and (2) requires only readily available, published data for its use. This model permits determinations of the water requirements of 488 cities grouped into 19 geographic regions or 'Pseudo States.' Separate regression functions have been fitted to the cities within each of the 19 regions. Derivation of the exact functions for each region entailed a cross section stepwise regression analysis in which some 8 different variables were examined. (Marriott-Chicago)
W71-00324

ELECTRONIC ANALOG MODELING AS AN AID IN WATER RESOURCE INVESTIGATIONS,
Soil Conservation Service, Hyattsville, Md. Central Technical Unit.
E. B. Warnick.
American Society of Agricultural Engineers Transactions, Vol 12, No 5, p 621-623, September-October 1969. 3 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Water resources, *Water resources development, *Investigations, *Analog models, Electronic equipment, Systems analysis, Streamflow, Surface waters, Groundwater, Irrigation, Precipitation (Atmospheric), Runoff, Crops, Wetlands, Turbidity, Reservoirs, Water management (Applied), Planning, Conjunctive use, Cost-benefit analysis.
Identifiers: Historical data, Sevier River Basin (Utah).

The complex interrelation of surface water, groundwater and return flow from irrigation diversions of the Sevier River Basin, Utah has fostered the use of an electronic analog model in processing data to aid in the water supply and distribution analysis. By using the analog model described, the Sevier River Basin Study staff has been able to analyze in more detail a greater variety of potential water management improvement projects. Because of this variety, it was possible to develop generalized relations to describe the possible future impacts on river flow and groundwater reservoirs caused by potential projects. Local sponsors of improvement proposals using the relations developed can plan a series of coordinated projects where the adverse downstream effects of a project in one area can be overcome by another project in the downstream area. This type of coordinated planning can maximize the economic benefits and minimize costly mistakes in managing the water resources available within the basin. Graphs, maps, tables of data and pictures of the analog model are included. (Woodard-USGS)
W71-00404

MATHEMATICAL MODEL OF SIMPLEST HYDROECOLOGICAL SYSTEM,
V. V. Menshutkin, and A. A. Umnov.
Trans. from Gidrobiol. Zhurn. No. 2, 1970. Available from NTIS as JPRS 50770, $3.00 in paper copy, $0.95 in microfiche. Joint Publications Research Service Trans 50770. June 18, 1970. 11 p.
Identifiers: *Ecology, Mathematical models, Marine biology, Aquatic animals, Population, Models (Simulations), Microorganisms, Plankton, Oxygen, Carbon dioxide, Algae, Organic compounds, Inorganic compounds, Energy conversion, Chemical reactions, USSR, *Food chains.

An abstract model of a hydroecological system including not only energy transformation and dissipation but also the turnover of organic and inorganic matter is presented. Inclusion of the cycle of biogenic elements in the model is an expansion of Vinberg's and Anisimov's ideas.
W71-00440

6B. Evaluation Process

FLOOD DAMAGE ABATEMENT-FEDERAL ASSISTANCE TO LOCAL GOVERNMENT.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 06F.
W71-00002

FLORIDA WATER AND RELATED LAND RESOURCES--ST. JOHNS RIVER BASIN.
Florida Dept. of Natural Resources, Tallahassee.

Florida Department of Natural Resources Report, 1970. 205 p, 72 fig, 53 tab, 337 ref.

Descriptors: *Water resources, *Water resources development, *Florida, Groundwater, Surface waters, Water sources, Water supply, Recreation, Irrigation water, Municipal water, Industrial water, Data collections, Hydrologic data, Hydrogeology, Aquifers.
Identifiers: St. Johns River basin (Florida).

A report on studies of water availability and use in the state of Florida covers approximately 11,431 square miles and includes all or parts of 19 counties in the St. Johns River basin. Sub-basins draining into the St. Johns River and the adjacent coastal sub-basin were included. Projections for the time frames 1980, 2000 and 2020 were used throughout. A broad hydrological inventory shows water occurrence and availability by source. Chemical and biological quality considerations are included. Major uses of the water resources are discussed by major user type and geographic area. Use projections are given by type and water source. Programs underway and planned by Federal, State, regional and local agencies are listed. Potentials for development are discussed as alternative solutions. The recreation situation in the basin is given with primary emphasis on water-related recreation. The recommendations are problem-oriented and are an extension of the potentials for development, land, and recreation sections. (Knapp-USGS)
W71-00010

DEVELOPMENT OF WATER RESOURCES IN APPALACHIA - PART I, SUMMARY REPORT.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.

Report on Development of Water Resources in Appalachia published in 25 volumes. Corps of Engineers, Office of Appalachian Studies Summary Report, Vol 1 of 25 Vol, Part 1, Main Report, December 1969. 241 p, 17 fig, 16 tab, 10 ref.

Descriptors: *Water resources development, *Water requirements, *Surveys, *Planning, *Appalachian Mountain region, Area redevelopment, Natural resources, River basin development, Water resources, Hydrologic data, Data collections, Investigations.
Identifiers: *Appalachian redevelopment.

The investigations required to carry out a special survey of water and related resources in the Appalachian Region have been completed, and the plan developed is summarized. The purposes of the water resources survey embrace two of the most important fields of national policy: economic development and growth, and natural resource conservation and development. These purposes are: to analyze the water resource potential in Appalachia in relation to the need for accelerated economic development in this region; to develop a long range plan under which the water resources of Appalachia may be effectively utilized to further the economic and social goals of the region. This plan will require coordination among Federal, State and local development efforts; to identify water and related resources investments which may be undertaken immediately or in the near future for the development of Appalachia; and to provide a framework of continuing cooperative relationships for further planning of water resources for Appalachian economic development. (See also W71-00052) (Knapp-USGS)
W71-00051

SOCIO-ECONOMIC PROBLEMS IN WATER RESOURCE USE AND CONTROL - PRODUCTION FUNCTIONS AND SOCIAL COSTS,
Auburn Univ., Ala. Water Resources Research Inst.
Donald R. Street.
Available from NTIS as PB-194 786, $3.00 in paper copy, $0.95 in microfiche. Auburn University School of Business Report Series 1, May 1970. 24 p, 11 fig, 8 ref. OWRR Project B-012-ALA (2).

Descriptors: *Water resources development, *Water management (Applied), *Economics, *Resource allocation, Multiple purpose, Systems analysis, Water conservation, Optimization, Benefits, Costs, Decision making, Operations research, Social aspects.
Identifiers: Resource management, Production functions.

Some production effects which are possible in water resource use and control, with implications on the economic welfare of the community are discussed. Recent research in Alabama and in other areas has shown that trends in the growth of industrial and municipal use of water indicate an increased incidence of conflicts which may affect future income alternatives. Problems appear in the form of various external effects, social costs, and interactional effects which originate according to the method or ordering of water resource use. Some opportunities and techniques for resource adjustment in solving water-related problems are discussed. The production function is fundamental to all economic development in an area. Basically, the production function is a relationship between inputs of resources, such as land, labor, and capital, and some product used by society. Systems analysis methods may also be adapted to solving resource allocation problems. (Knapp-USGS)
W71-00166

SELECTED BIBLIOGRAPHY-LOWER MEKONG BASIN.
United Nations Engineer Agency for Resource Inventories, New York.
For primary bibliographic entry see Field 10.
W71-00229

COMPETITIVE RECREATIONAL USES OF SELECTED IOWA LAKES,
Iowa State Water Resources Research Inst., Ames.
Arnold O. Haugen, and Arnold J. Sohn.
Available from NTIS as PB-194 800, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Iowa State Water Resources Research Institute, June 30, 1968. 173 p, 45 tab, 38 fig, 21 ref, 2 append. OWRR Project A-005-IA (1).

Descriptors: *Recreation, Recreation facilities, *Boating, *Lakes, Swimming, Recreation demand, Boat-launching ramps, *Water utilization, Iowa, Sport fishing, Waterfowl, Hunting.
Identifiers: *Recreational use patterns, Clear Lake, Spirit Lake, Okoboji Lake, Little Wall Lake, Eagle Lake, Ventura Marsh.

A study to determine cycles and fluctuations in recreational activity was conducted during 1966 and 1967 on Clear, Spirit, Okoboji, and Little Wall Lakes. Major emphasis was placed on summer activities, with checks of waterfowl hunting intensities on Eagle Lake and Ventura Marsh conducted during the fall hunting seasons. In addition to describing activity cycles, an attempt was made to analyze areas of present or future conflict between users. Primary sources of data included: Time-lapse movie camera records as indices to activity cycles; questionnaires to short-term visitors and permanent residents on the lakes; pneumatic car-counter records at park entrances and boat-launching ramps; line intercept counts of boat traffic; counts and location plottings of boats on the lakes; and interviews with lake personnel including Water Safety Patrol officials, resort operators, and other businessmen located near the lakes. It is recommended that: (1) a limit of 50 be placed on the number of power boats permitted on Little Wall Lake at one time, or on the size of motors allowed on the lake; (2) steps should be taken immediately to isolate swimming facilities from boat launching facilities, a minimum distance of 300 feet should be allowed between ramps and swimming areas; (3) lake front property should be acquired at a resonable price in the future. Portions of Clear and West Okoboji lakes should be zones to a 'No Wake' speed for power boats, thereby providing areas for fishing, canoeing, etc.; (4) marshes such as Eagle Lake should be managed for waterfowl production and hunting areas. Drainage, dredging, or flooding, other than to improve waterfowl conditions, is not recommended, (5) opening of newly constructed reservoirs in Iowa will require studies to analyze changes and other trends in recreational use patterns.
W71-00230

ENGINEERING AND ECONOMIC RELATIONS IN THE SELECTION AND CLASSIFICATION OF IRRIGABLE LANDS,
Bureau of Reclamation, Denver, Colo.
John T. Maletic, and Waldron H. Yarger.
7th Congress on Irrigation Drainage, Quest 26, Rep Disc, R1-R33, p 26.297-26.310, Mexico City, 1969. 16 p, 4 fig, 19 ref.

Descriptors: *Land classification, Land development, Land reclamation, Land settlement, Land resources, Land use, Engineering, Economics, Land, *Irrigable land, Project planning, Social aspects, Farms, Irrigation, Farm units, Drainage, Economic feasibility, Bibliographies.
Identifiers: Engineering economy, *Selection, Irrigated agriculture.

Successful settlement of irrigation projects can best be handled by integration prior to construction of the project facilities of several disciplines into a forecast of desirable and practical measures for development of each farm unit. An irrigation suitability classification provides the basic information on land resources of the project area. Unlike soil surveys, many initial agronomic, economic, and engineering aspects of project planning are incorporated in this classification. Subsequent integration with drainage costs, water service costs, and economic limitations permits the selection of lands to be served and a forecast of requirements for farm unit development, such as landforming, drainage, farm water application facilities, soil amendments, farming equipment, and credit and capital requirements. The project plan should include a forecast and timing of who will provide the amount of capital and labor inputs for putting the land into production most expeditiously. In the developing nations, irrigation project planners should make a special effort to develop plans reflecting the social and cultural environment which, to a large extent, determines the success of the project. (USBR)
W71-00262

A REVIEW OF INTER-REGIONAL AND INTERNATIONAL WATER TRANSFER PROPOSALS.

West States Water Council, Salt Lake City, Utah. June 1969. 13 p, 3 map, 30 ref.

Descriptors: *Water resources, Water resource development, *Planning, Natural resources, *Inter

basin transfers, Surplus water, Reviews, Water supply, Foreign countries, Mexico, Bibliographies.
Identifiers: Western States Water Council, Canada, *Interbasin water transfer, International relations, *Water plans.

Large-scale water transfers reviewed are international in scope and involve Canadian sources. Until Canada has fully evaluated future needs and resources of the prairie provinces, very little serious discussion of any proposal to export water from central Canada is expected. Fourteen interregional and interbasin water transfer plans in the U S are discussed. Inventories of water and land resources, and the development of statewide and basinwide water plans are needed. Any meaningful large-scale water transfer proposal should be the result of careful basin-by-basin evaluation of natural supplies, thoughtful projections of future needs, and cooperative consideration of long-range development. (USBR)
W71-00265

THE RELATIONSHIP AMONG THE FEDERAL GOVERNMENT DISTRICT BOARDS, MANAGERS AND WATER USERS ON NEW IRRIGATION AND DRAINAGE PROJECTS,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03F.
W71-00268

THE MEASUREMENT OF BENEFITS OF TROUT FISHING: PRELIMINARY RESULTS OF A STUDY AT GRAFHAM WATER, GREAT OUSE WATER AUTHORITY, HUNTINGDONSHIRE,
Birmingham Univ. (England). Dept. of Industrial Economics and Business Studies.
Robert J. Smith, and N. J. Kavanagh.
Journal of Leisure Research Vol 1, No 4, p 316-332, Autumn 1969.

Descriptors: *Recreation, *Fishing, *Demand, Benefits, Costs, Economic evaluation, Statistics, Planning, Prices, Reservoir, Time.
Identifiers: *Grafham Water, *Demand curve, *Willingness to pay, Visitation rates.

This paper is concerned with the empirical estimation of a demand curve for a trout fishery. The reasons for measuring the economic benefits of recreation and the difficulties involved in obtaining an objective measure of these benefits are discussed. The authors explain the economist's approach to recreation valuations and outline several benefit measures. A measure of benefits requires information on prices. The methodology developed by M. Clawson to provide this type of information is described. The basis of this approach is a relationship between distance and visitation rates from zones surrounding the fishery. Using this methodology the authors attempt a study of the data on trout fishing at Grafham Water. They measure the recreational demand for trout fishing at this site, as well as estimate the monetary benefits of trout fishing under various assumptions with respect to the valuation of angler's time. (Murphy-Rutgers)
W71-00275

ECONOMIC ASPECTS OF THE ENVIRONMENT,
Resources For the Future, Inc., Washington, D.C.
Allen V. Kneese.
In: Regional Planning Challenge and Prospects New York, Frederick A. Praeger, 1969, p 88-91.

Descriptors: *Decision making, *Water pollution, *Natural resource allocation, *Economies of scale, *Regional analysis, *Planning, Technology, Taxes, Government, Watercourse, Costs, Reservoirs, Waste treatment.
Identifiers: Externalities, Market place, Spillover costs, Urban economics.

This article discusses the approach of economics to problems of environmental quality. It is proposed that normative economic theory's basic premise that individual choice should govern resource use to its maximum extent, is useful in such environmental problems. Three major questions are discussed in order to increase the efficiency of the decision-making process in determining the allocation of resources. The first is whether a satisfactory allocation of income exists which would facilitate a collective ethical standard in environmental quality. The second is whether decisions on the use of resources are really independent of each other- i.e. are the costs of using a watercourse for waste disposal borne only by those deciding to use the watercourse for that purpose. The third and final question asks whether collective decision making can realize economies of scale inherent in the economy's technology. The questions have arisen from the problems of pollution in regional planning and should aid the economist in a decision-making position in the water resources area. (Murphy-Rutgers)
W71-00276

TIME BIAS IN RECREATION BENEFIT ESTIMATES,
Battelle Memorial Institute, Columbus, Ohio.
Frank J. Cdsario, and Jack L. Knetsch.
Water Resources Research, Vol 6, No 3, p 700-704, June 1970.

Descriptors: *Economic value, *Recreational demand, Constraint, Water resource development, Monetary costs, Economic welfare.
Identifiers: *Recreational benefit, *Time cost, *Trade-off function, *Bias, Travel costs, Proxy, Indivisibilities, Convexity.

The authors are concerned with the measurement of outdoor recreation benefits associated with activities involving water resource use. A benefit measure is defined operationally in terms of what an individual would be willing to pay to use the resources rather than have to go without the resource services. The willingness to pay criterion is measured by the area under the aggregate demand curve. Previous attempts at estimating the benefits of outdoor recreation have involved the estimation of recreation demand curves with travel cost data as a proxy for prices. This method related changes in cost of visits to changes in number of visits per capita. There has been a conservation bias in the benefit estimate obtained because of the omission of travel time differences. This article suggests the use of a trade-off function between money and time costs in order to eliminate bias. The author expects larger recreation benefits through the use of this technique. This refinement in the measurement of outdoor recreation should be an aid to overall water resource planning. (Siegenthaler-Rutgers)
W71-00277

WEIGHING RISK IN CAPACITY EXPANSION,
Lilly (Eli) and Co., Indianapolis, Ind.
John R. Virts, and Richard W. Garrett.
Harvard Business Review, Vol 48, No 3, p 132-141, May-June 1970. 6 fig, 1 tab, 1 append.

Descriptors: *Risks, Distribution patterns, Forecasting, Computer models, Statistical methods.
Identifiers: *Capacity, Production facilities, Affordable risk ratio, Capacity expansion.

A company's manufacturing capacity must be designed to support its marketing plans while also satisfying corporate strategy and objectives. But because the uncertainties of product and process forecasts tend to be cumulative, the task of estimating future requirements for facilities, which depends on these prior forecasts, is a difficult one. A first step in developing a facilities plan is to balance the risks and uncertainties of forecasts with the economic penalties of having too much or too little capacity. However, figures for sales and yields are normally uncertain, and forecasts are continually being revised. As such, facilities planning becomes complex. The authors develop a method of measuring the risk in facilities planning making use of computerized model of plants serving worldwide markets. The model uses operations research and microeconomic theory to produce an affordable risk ratio. This has been used by Eli Lilly and Company to compare alternative plans for expansion of facilities. This may prove to be of interest to the water researcher concerned with decisions pertaining to the creation of new facilities. (Loeb-Rutgers)
W71-00283

DO MANAGERS FIND DECISION THEORY USEFUL,
Michigan Univ., Ann Arbor.
Rex V. Brown.
Harvard Business Review, Vol 48, No 3, p 78-89, May-June 1970. 1 fig.

Descriptors: *Decision making, Probability, Return costs, Benefits, Risks, Management.
Identifiers: *Decision theory analysis, *Decision theory, *Manager, Quantitative analysis, Obstacles.

The author presents in this paper a discussion pertaining to decision theory. In particular, the author considers a set of techniques of quantitative analysis which is referred to in the paper as Decision Theory Analysis (DTA). The primary purpose of this article, which is based on a survey of 20 companies, is to present some of the experiences of practitioners who have been exploring various applications of DTA techniques to management decision making. These experiences should help would-be users to identify particular situations in their own companies where the new technology might greatly benefit them, and to build on the lessons learned by earlier users. The aritcle discusses such questions as: the tangible impact DTA has on how businesses are run and how individual decisions are made, the areas of decision making DTA is best suited for, what practical benefits result, what trends in usage are apparent, what obstacles lie in the way of more effective usage, how management can make the use of DTA more effective and what remains to be done in developing and expanding the usefulness of DTA. This may prove valuable to the water researcher or water manager involved with decision making. (Loeb-Rutgers)
W71-00284

PUT POLICY FIRST IN D C F ANALYSIS,
Olivetti Co., Ivrea (Italy).
Paul Welter.
Harvard Business Review Vol 48, No 1, p 141-148, January-February 1970.

Descriptors: *Investment, *Economic evaluation, *Discount rate, *Costs, *Capital, Interest rate, Financing, Computers, Rate of return, Risk, Decision-making, Profit, Taxes, Management.
Identifiers: *Discounted cash flow, Growth, Debt/equity ratio, Bonds, Logic flow chart.

The problems of evaluating alternative investments in the water resource area are numberous and have led, in many instances, to the use of discounted cash benefit flow (DCF) as the most appropriate tool for investment appraisal. The author discusses the two major processes involved in DCF analysis; calculating DCF, and determining the appropriate discount rate. The calculation of DCF involves a decision as to the proper method, either rate of return net present value or discounted pay-back period. Once this is done it is necessary to estimate the cash flow and to evaluate the risks involved. The author next discusses the determination of the discount rate. This is especially troublesome in the water resource area due to the presence of externalities. The proper rate is evaluated in terms of the minimum acceptable rate of return and the need for future investment capital. With the inclusion of social benefits into the discount rate this method is directly applicable to water resource investments. (Murphy-Rutgers)

W71-00285

MANAGEMENT EVOLUTION IN THE QUANTITATIVE WORLD,
Virginia Univ., Charlottesville.
Robert F. Vandell.
Harvard Business Review Vol 48, No 1, p 83-92, Jan-Feb 1970.

Descriptors: *Management, *Statistical methods, *Data processing, Economic efficiency, Computers, Technology, Costs, Benefits, Financing, Labor, Programs, Planning, Risk, Decision-making.
Identifiers: *Quantitative analysis, Decentralization, Manpower, Hardware, Marketing, Mobility.

The recently acquired tools of quantitative analysis and data processing have made possible more complete evaluations of investment alternatives in the water resource area. However, this article shows that management must undergo some radical changes if these tools are to be utilized fully. The author discusses the shape these changes will take and sets forth some guidelines managers can use in preparing themselves for the changes. The evolution of more economically efficient methods of management over the next decade will suffer sharp discontinuities unless a concerted effort is made to understand these two tools. The relevance of the author's observations to water utility management makes this article of interest to the water researcher. (Murphy-Rutgers)
W71-00286

RISK AND THE SOCIAL RATE OF DISCOUNT,
Northwestern Univ., Evanston, Ill.
Mark V. Pauly.
American Economic Review Vol LX, No 1, p 195-198, March 1970.

Descriptors: *Rate of discount, *Investment, *Government, Risk, Income, Cost benefit analysis, Economic evaluation, Rate of interest, Economic efficiency, Taxes.
Identifiers: *Social rate of discount, Public investment, Bonds, Rate of return.

The article attempts to clear up the controversy about the proper rate of discount to use in evaluating benefit and cost streams from public investment. Since a proper discount rate is an important part of the economic evaluation of water resource projects, this article should be of use to the water researcher. The author shows that the rate at which individuals are willing to loan money to the government necessarily understates the true social cost of the investment and should not be used as the social rate of discount. It is also shown that if taxation-induced distortions are ignored, the correct rate for evaluating government investment opportunities may be equal to, or greater than, the private rate of return. (Murphy-Rutgers)
W71-00287

APPROACHES TO VALUE CHOICES,
Wayne State Univ., Detroit, Mich.
Norman Wengert.
In: Regional Planning-Challenge and Prospects, New York, Frederick A. Praeger, 1969, p 98-102.

Descriptors: *Environmental effects, *Cost-benefit analysis, *Planning, Decision-making, Streams, Technology, Natural resource allocation, Economic analysis, Engineering personnel, Sanitation.
Identifiers: *Environmental change, Democracy, Majority rule, Economists, Professional interest, Sanitarians.

This article discusses the problems of values in environmental planning. The author points out that environmental decisions will be effected by the often conflicting goals of different professionals with different objectives. Such individuals as economists, engineers, sanitarians, and fishermen would have widely diverse suggestions about what would be environmentally best for a stream. Such differences are based on technological background, authority, and associates of each person involved. To deal with such difficulties, the author suggests three basic needs. The values must be identified, an awareness of mechanisms and processes for making value choices must be developed, and it must be recognized that value decisions often involve hard choices. The author stresses the importance, in decision-making for environmental planning, of a cost benefit analysis of the factors involved. Finally, it is emphasized that, to be rational, environmental planning must be constantly directed toward a specific goal, thus necessitating long-range as well as short-range planning. (Murphy-Rutgers)
W71-00289

AGENCY BUDGET PROBLEMS,
Bureau of the Budget, Washington, D.C.
Carl W. Teller.
In: Public Budgeting and Finance, Itasca, Illinois, Peacock Publishers, 1968, p 332-338.

Descriptors: *Budgets, *Government, Decision-making, Planning, Evaluation, Priorities, Efficiency, Financing, Forecasting, Environment, Costs, Economic impact, Economic justification.
Identifiers: *Governmental agencies, *Budget cycle, Budget presentation.

Budgeting serves as a means of weighing choices and determining priorities. Thus this clarification of some of the problems involved should aid the decision-maker in the water resource area. The basic budget considerations which must be considered are outlined and the five most important facets of a budget officer's responsibility discussed. The author then studies problems of budgeting in government agencies which he considers as problems of environment, problems inherent in the budget process or problems relating to budget presentation. These difficulties are analyzed and suggestions made to alleviate them. Throughout the article the author stresses the need to make the budgeting process a more effective tool for decision-making. (Murphy-Rutgers)
W71-00290

IDENTIFICATION AND SPECIFICATION ANALYSIS OF ALTERNATIVE EQUATIONS FOR ESTIMATING THE ELASTICITY OF SUBSTITUTION,
Tulane Univ., New Orleans, La.
J. R. Moroney.
The Southern Economic Journal Vol XXVI, No 3, p 287-299, January 1970.

Descriptors: *Profits, *Returns to scale, Economic evaluation, Capital, Labor, Model studies, Maximization, Statistics, Economic efficiency, Demand, Industrial production, Optimization, Prices, Costs.
Identifiers: *Elasticity of substitution, *Production function, Cost minimization.

This paper seeks to examine the nature of the assumptions of many previous authors, in estimating the elasticity of substitution between capital and labor, regarding constant returns to scale and purely competitive product and factor markets. The author suggests that the usual estimates of the coefficients of the production function are biased because of certain specification errors. The article proposes an alternative estimation that is not restricted by the above assumptions. The author argues that this alternative equation is free from specification errors and is suitable for estimation under conditions of non-constant returns to scale and imperfectly competitive product markets. Attempts at estimating production functions for the water utility industry have been hampered by the use of the profit-maximizing relation with which the author finds fault. The reliance on the cost minimization relationship that the article suggests, should more accurately describe the elasticity of substitution in the water resources area. (Murphy-Rutgers)
W71-00291

ALTERNATIVE RATE OF RETURN CONCEPTS AND THEIR IMPLICATIONS FOR UTILITY REGULATION,
Stanford Univ., Calif.
Ezra Solomon.
The Bell Journal of Economics and Management Science Vol 1, No 1, Spring 1970, p 65-81.

Descriptors: *Capital, *Costs, *Discount rage, *Economic evaluation, *Utilities, *Government, Depreciation, Growth rates, Prices, Investment, Taxes, Model studies, Budgets, Forecasting, Planning.
Identifiers: *Rate of return, *Utility regulation, Book rate unit, Expensing policy, Discounted cash flow.

The rate of return on invested capital is widely used as a basis for decisions in utility regulation. One of its essential purposes is to provide a comparison between actual or prospective performance and the cost of capital, which is the required or expected performance. Large utilities often set prices to achieve the rate of return dictated by the regulatory agencies. However, there is a problem in that the rate of return is measured in terms of two distinct units. The book rate unit is defined as the ratio of income during a given period of time to the net book-value of invested capital outstanding. The discounted cash flow unit measures the return on capital in terms of the annual rate at which the future new funds flows from an investment have a discounted value equal to the value of investment outlays required to bring about these fund flows. This paper indicates the relationship between the two measures and shows the impact of some variations in depreciation and expensing procedures, growth rate, etc. The paper should be of use in the regulation of water utilities. (Murphy-Rutgers)
W71-00292

TAXATION, SUBSTITUTION AND INDUSTRIAL LOCATION,
Rice Univ., Houston, Tex.
Charles B. McLure.
Journal of Political Economy, Vol 78, No 1, p 112-132, Jan-Feb 1970.

Descriptors: *Taxes, *Government, *Economic evaluation, *Model studies, Consumption, Prices, Government supports, Capital, Income, Mathematical studies, Labor wages, Demand, Industry.
Identifiers: *Industrial location, *Factor mobility, *Substitution, Unemployment, Elasticity.

This paper is an attempt to develop a theory on the impact of tax policy on the location of industry. It is relevant to the water resource planner interested in the effect on the regional economy of resource development projects. A general equilibrium neoclassical model is used to outline several important determinants of the sensitivity of industrial location to various general taxes levied in a state. This model may be extended to measure the effects of water resource projects on the local economy. The model employs comparative statics analysis to emphasize the role played by substitution in consumption and production and by the mobility of factors in determining the direction and strength of industry's locational response to taxation. The examination is limited to the analysis of the capital flows induced by interstate differentials in various kinds of general taxes in a full employment economy. (Murphy-Rutgers)
W71-00293

THE ECONOMICS OF CONGESTION AND POLLUTION: AN INTEGRATED VIEW,
Massachusetts Inst. of Tech., Cambridge.
Jerome Rothenberg.
American Economic Review Vol LX, No 2, p 114-121, May 1970.

Descriptors: *Environmental pollution, *Economic evaluation, *Mathematical models, Prices, Income, Planning, Profit, Demand, Cost, Government, Population, Sewerage, Benefits, Economic efficiency, Optimization, Resource allocation, Investment.

entifiers: *Public goods, *User charges, *Urban ngestion, *Generic congestion.

nvironmental pollution and urban congestion ave much in common and an exploitation of this milarity throws light on why the problems are so itical, what their consequences are and what nds of measures can be used to mitigate their mage. This paper integrates the distinctive aracteristics of the two together, as aspects of e phenomenon. The author first discusses the na- re of the socioeconomic interaction. The ramifi- tions are then explained through the use of a athematical model treating both the positive and rmative considerations. Under the broad classifi- tion of the generic congestion process, some spe- alized forms of congestion and pollution are con- dered. The author demonstrates that a system thout congestion charges will differ from one th charges primarily by more congestion at any e time and a more rapid worsening of the oblem over time. As a part of environmental pol- tion, water pollution abatement could benefit om the application of the conclusions reached re. (Murphy-Rutgers)
71-00294

CTIVITY SPECIALIZATION AMONG OHIO'S ECREATION BOATERS,
exas A and M Univ., College Station; and Ohio ate Univ., Columbus.
arlton S. Van Doren, and Barry Lentnek.
ournal of Leisure Research Vol 1, No 4, p 296- 15, Autumn 1969.

escriptors: *Recreation, *Boating, *Demand, Economic evaluation, Statistics, Water demand, ocial aspects, Time, Lakes, Regression analysis, omputer program, Fishing.
dentifiers: *Automatic Interaction Detector, Multivariate techniques, Social status, Boating quipment, Recreational time, Activity analysis, ailing, Water skiing.

n order to plan outdoor recreational facilities to eet future requirements of a large urbanized opulation, demand for specific outdoor activities ust be estimated. For this it is necessary to know e social and economic characteristics of persons ngaging in specific activities. This article attempts identify the characteristics that differentiate oat activity specialists. The authors review the terature dealing with this problem and then sum- arize the methodological problems of predicting emand factors for outdoor recreation. They use e Automatic Interaction Detector program, hich is a multivariate technique, as a predictive ol for characterizing activity preferences. Twen- y-one variates were used to describe the demo- raphic characteristics of the boating parties, the mount of time spent boating and the kind of quipment used. The authors conclude that the ormal social variates are not predictive of activity pecialization. This article is relevant to water stu- ies attempting to forecast the recreational use of a ater project. (Murphy-Rutgers)
71-00297

COORDINATION IN ENVIRONMENTAL PLANNING,
New York State Dept. of Health, Albany.
Meredith H. Thompson, and M. M. Hufschmidt.
n: Regional Planning-Challenge and Prospects, New York, Frederick A. Praeger, 1969, p 103-105.

Descriptors: *Planning, *Water pollution, Economic evaluation, *Regional analysis, Water esources, Land use, Waste treatment, Air pollu- ion, Navigation, Urban renewal, River basin, En- ironmental effects, Government, Training, Sewerage.
dentifiers: *In service training, *Environmental lanning, Housing.

The authors reiterate the need for coordinated en- vironmental planning and suggest that water resource planners, land use planners, zoners, realty planners, solid waste planners, and air pollution planners must all be brought together to achieve comprehensive environmental planning. Coordination is the key to this, since it is logically impossible to include in a single organization all of the persons responsible for transportation, water resources, or urban renewal development in one region. Such comprehensiveness does not demand unification under one particular bureau, but rather coordinated activity of several pertinent agencies. For instance, comprehensive water pollution control includes groundwater pollution, which in turn involves housing, zoning, and land use. However, the author does point out that a single agency must be responsible for working with comprehensive short and long range plans to integrate agency findings into a final workable product. (Murphy-Rutgers)
W71-00301

A METHODOLOGY FOR THE CONSTRUCTION OF ATTITUDE MEASURING INSTRUMENTS,
Missouri Univ., Rolla.
R. N. Sawyer, and T. E. Harbaughn.
Water Resources Bulletin, Vol 6, No 3, May-June 1970, p 401-407. 3 fig, 15 ref.

Descriptors: *Attitudes, *Methodology, Instrumentation, Decision-making, Water resources, Planning.
Identifiers: *Attitude scale, Opinions, Likert scale, Thurstone scale.

To the average layman, the distinction between opinion and attitude is artificial at best, and is neither consistant nor logically defensible. For many purposes one need not distinguish between the two. However, when assessing opinion and attitude the disparity becomes quite evident. Opinion surveys are characteristically concerned with replies to specific questions which need not be related. The responses are kept separately as opposed to being combined into a total score. Attitude scales, on the other hand, typically yield a total score indicating both a direction and intensity of an individual's feelings, thoughts, and predispositions to act toward a given concept. Further, in the construction of an attitude scale, the different statements are designed to measure a single attitude or unidimensional variable. The Likert method of constructing attitude measuring instruments requires a large number of judges to indicate their own attitudes by responding to statements thought to pertain to an attitude in question. Five possible responses are provided for each item. The procedure to construct a Thurstone type scale utilizes The Law Categorical Judgement as a basis. Statements are obtained and analyzed for the various categories and in final form, the attitude scale is presented to the respondent who indicates statements with which he agrees or disagrees. (Marriott-Chicago)
W71-00309

PUBLIC INVESTMENT AND PLANNING: A RESPONSE,
National Audubon Society, New York.
Roland C. Clement.
Water Spectrum, Vol 2, No 2, p 1-4, Summer 1970. 7 ref.

Descriptors: *Planning, *Investment, Institutional constraints, Institutions, Federal government, Coordination, Administration, Social values, Management, Multiple purpose projects.
Identifiers: *Public investment, *Bureaucracy, Multiple-objective programs, U.S. Army Corps of Engineers.

This article is a response to an earlier article on public investment and planning by Arthur Maass. It is felt that the earlier piece did not integrate the various points which were well made and that in several cases, the analysis was insufficient. Several areas of difference are indicated. First, the Corps of Engineers is not really prepared to execute multi-objective programs due to 'bureaucratic schizophrenia,' i.e., an old line civilian bureaucracy oriented toward maintaining project authorizations and the more flexible and advanced military policy-makers. Second, a more rational role in water resources by the Corps is impossible without a reassessment of national needs. Finally, the question of whether the Corps can develop a realistic water resource program is not only a question of capability but also of willingness. (Davis-Chicago)
W71-00310

NEW CONCEPTS IN WATER RESOURCES PLANNING,
Corps of Engineers, Chicago, Ill. North Central Div.
James S. King.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968), ed. Phillip Cohen, Martha N. Francisco, p 703-710.

Descriptors: *Planning, *River basin development, *Multiple-purpose projects, *Federal government, State governments, *Local governments, *Institutional constraints, Water Resources Planning Act, Economic efficiency, Interagency cooperation.
Identifiers: *Multiple objectives, *Corps of Engineers, *Criteria, *Mississippi River Basin Study, *Legal constraints, Non-government interests, Green Book, Kerr report, Senate Document No. 97, Water Resource Policy Commission, Missouri Basin Survey Commission, Advisory Committee on Water Resources Policy, Public Law 89-4, Interdisciplinary approach.

Comprehensive water and related land resources planning is a technique of decision making pertaining to the allocation of scarce resources among competing claims. Its ultimate objective is to provide a sound basis on which public investment decisions can be made. An historical picture is given beginning with Federal and State concerns regarding navigation and later irrigation. Hydroelectric power and improved quantity and quality of water supplies followed. Theodore Roosevelt's recognition of conservation initiated a philosophy of integrated multipurpose river basin planning. During the 30's the Corps of Engineers surveyed the major river basins and Federal-State-local drainage commissions were established for all of them. Developments after World War II are reviewed including principles of economic analysis in the 'Green Book', three Presidential Commissions during the 50's, the Kerr report, Senate Document No. 97, the Water Resources Planning Act, and Public Law 89-4. The author suggests that a multiple-objective approach is needed and mentions three broad areas of responsibility and action: Establishment of broad, first-line objectives at the national level; central planning to translate first-line objectives into criteria for formulating plans; formulating an optimum water resources plan, or alternative plans, by field level planning groups. Two types of comprehensive basin studies are suggested: those appraising the institutional and legal constraints thus providing a 'framework' and those utilizing these 'frameworks' within a detailed sub-basin. Observations of the Type 1 Upper Mississippi River Comprehensive Basin Study are included. Three alternative first-line objectives are outlined and it is suggested that one plan is able to satisfy them to varying degrees. (Preckwinkle-Chicago)
W71-00316

URBAN (MUNICIPAL) WATER MANAGEMENT,
Syracuse Univ., N.Y. Coll. of Forestry.
Robert D. Hennigan.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968) ed. Phillip Cohen, Martha N. Francisco, p 716-723.

Descriptors: *Administration, *Urbanization, *Water supply, *Drainage, *Waste water disposal, *Water quality, *Economic efficiency, *Utilities Federal government, State government, Local government.

Identifiers: City of New York, Suffolk County, Buffalo-Erie County, Nassau County, Monroe County.

The author argues that the major water resources problem in the country today is poor urban water management. Urban water management consists of water supply development and distribution, surface drainage collection and disposal, and waste water collection treatment, and disposal. With increasing urbanization local water regimen changes drastically resulting in loss of base flow, and in greatly increased storm flows. Rapid runoff also adds to the pollution load. Controversies related to urban water management are mentioned including allocation of Delaware waters involving Delaware and New York, the Colorado River controversy involving Los Angeles, the Chicago Diversion Case, and pollution of the Great Lakes and various other waters. The other traces development of water management from rural society where individual responsibility existed through further developments that dealt with problems as they arose. Resulting from this was a separation of water supply service from other services. Following World War II multiple governmental units were becoming more evident in large urban communities and consolidation efforts rare. Both technically and organizationally, water management needs cannot be dealt with separately. The bases for both the optional governmental service concept and for essential utility services concept are listed in two sets of propositions. Conclusions are that all three services should be consolidated in all urban areas, and given an independent revenue base and status. Financing should be based on user charges. (Preckwinkle-Chicago)
W71-00317

LAND AND WATER RESOURCES MANAGEMENT FOR ENVIRONMENTAL IMPROVEMENT,
Department of Agriculture, Washington, D.C.
Lloyd E. Partain.
Water Resources Bulletin, Vol 6, No 2, April 1970, p 229-234.

Descriptors: *Land management, *Water management, Conservation, Education, Attitudes, Research and development, Decision making.
Identifiers: *Environmental management, *Public awareness, Educational programs.

Traditional conservation measures may not be, and usually are not, all that is needed to assure a quality environment. They are, however, fundamental. A national course of action involving land and water management is determined (1) at the market place, (2) at the ballot box, and (3) in the hearts and minds of individuals. To inform people about environmental management and conservation and appropriate uses of land, water and related resources is an exceedingly difficult problem. Research, action and educational programs dealing with environmental problems must have greater attention and support. (Marriott-Chicago)
W71-00320

EFFECTIVE WATER RESOURCES MANAGEMENT IN THE URBAN SETTING,
Colorado Univ., Boulder. Dept. of Civil Engineering.
J. Earnest Flack, and Duane W. Hill.
Water Resources Bulletin, Vol 6, No 4, p 563-572, July-Aug 1970. 3 fig, 18 ref.

Descriptors: *Water management, *Cities, Flood plain management, Attitudes, Administration, Social aspects, Psychological aspects, Systems analysis, Planning, Behavior.

Water resources management in the urban areas of the United States to be effective must include dimensions far beyond water supply and sewage. This paper concerns itself with those problem areas of water resource management outside of potable water supply and sanitary sewers. These areas include flood plain management, greenways and blueways, storm water, vistas of waterways, and other attributes of living in or near a water-related environment. The perceptions and attitudes of the concerned public and community power structure must be known in order to manage the water environment effectively. Methods of measuring these perceptions and attitudes are described and ways in which the resulting citizen-resource can be tapped and use as a management device are explored. (Marriott-Chicago)
W71-00322

WATER OF THE WORLD AND ITS FUTURE,
Akademiya Nauk SSSR, (Moscow).
M. I. Lvovitch.
Water Resources Journal, United Nations-Economic Commission for Asia and the Far East (ST/ECAFE/SER. C/83), p 1-26, December 1969. 26 p, 8 tab, 21 ref.

Descriptors: *Water resources development, *Water reuse, *Water demand, *International waters. Water law, Water supply, Water management (Applied), Water utilization, Planning.
Identifiers: World water use.

The threat of water resources depletion exists and in some regions it has already become a reality. The main reason for this state of affairs is that the policies on which the use and conservation of water resources have been, and are supposed to be based in the future, have, as a rule, become outdated. They were applicable in the past when water needs were small in relation to the available water resources. In many regions which were previously considered rich in water resources, a water deficit has become or is becoming apparent. These regions are found in almost all of Europe, considerable parts of Asia and Africa, and the southern part of North America. A water crisis is not inevitable. The depletion of water resources can be avoided: mankind need not be threatened by a water crisis if more rational policies are adopted in the use and conservation of water resources. An end must be made to the use of rivers, lakes, reservoirs and seas as media for the purification of sewage waters. A start must be made to reducing the water consumed in production in every possible way; decreasing the water consumption per unit of production; searching for ways and means to change over to 'dry' production; and eliminating unproductive losses through evaporation from water and soil surfaces. It may be possible to transform and regulate the hydrologic cycle. More attention should be devoted to the problem of locating population and industry in accordance with the distribution of water resources. It is essential to observe a multi-purpose approach in solving water economy problems. (Knapp-USGS)
W71-00398

HAZARDS TO PEOPLE AND ANIMALS FROM BUREAU-CONSTRUCTED CANALS, OPEN AND CLOSED CONDUIT SYSTEMS PROGRAM,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08A.
W71-00437

TEXAS MARINE RESOURCES: THE LEISURE VIEW,
Texas A and M Univ., College Station.
Clare A. Gunn.
Available from NTIS as PB-192 956, $3.00 in paper copy, $0.95 in microfiche. June 1970. 21 p. TAMU-SG-70-110.
Identifiers: *Natural resources, Seacoast, *Economics, Texas, Mexico Gulf, Symposia, Geography, Recreation, Problem solving, Management planning, Climatology, Commerce, Fishes, Transportation, Culture, Sea Grant program, Tourism, Marine resources.

This booklet represents a summary statement of the third Texas A and M University Sea Grant Workshop. 'Marine Resources: Leisure Uses.' The meeting was one in a continuing series of working sessions designed to find out the views of various user groups concerned with marine resource development in Texas. The statement is one of consensus. It reflects the concern of each participant for a well-managed coastal zone for the state. (Author)
W71-00438

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00446

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM SALLISAW, OKLAHOMA.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 03E.
W71-00456

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, DESHA COUNTY, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 03E.
W71-00457

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM, VAN BUREN, ARKANSAS.
Garver and Garver, Inc., Little Rock, Ark.
For primary bibliographic entry see Field 03E.
W71-00458

WATER QUALITY CRITERIA FOR SELECTED RECREATION USES,
Illinois Univ., Urbana. Water Resources Center.
Doyle D. Bishop, and Robert Aukerman.
Available from NTIS as PB-195 164, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center, Research Report 33, September 1970. 134 p, 18 tab, 22 ref, append. OWRR Project B-034-ILL (1).

Descriptors: Recreation, *Water quality, *Attitudes, *Behavior, Water pollution effects, *Standards, *Planning, *Recreation demand.
Identifiers: Perceptions, User satisfaction, Criteria, Quality of experience.

Four types of outdoor recreationists were investigated to determine whether they differed in their attitudes, beliefs, and behavior regarding various water characteristics at Central Illinois water-based recreation sites. Using an attitude model derived from social-psychological research, the recreationists' attitudes toward the sites were estimated from their attitudes and beliefs about water characteristics. The site attitudes were regarded as indicators of the quality of the respondents' recreation experience resulting from characteristics of the water. The major analyses were comparisons of the recreationist groups' perceptions of the water, attitudes toward water characteristics, the site attitudes held because of water characteristics, reports of decreased site use because of water characteristics, and reports of probable termination of site use because of water characteristics. The relationships between site attitude components resulting from selected water characteristics and the reports of decreased site use and probable termination of use were also investigated. The results indicated that the four types of recreationists differed in their perceptions of the water, attitudes toward water characteristics, site attitudes, and the reported water characteristics that had caused or might cause decreased site use. In addition to these

group differences, there were strong individual differences within the various groups. Site attitudes were not highly related to reported behavior.
W71-00471

INLAND PORT FACILITIES AND ECONOMIC GROWTH,
Mississippi State Univ., State College. Bureau of Business and Economic Research.
A. A. Armenakis, H. J. Moore, and G. T. Peden.
Available from NTIS as PB-195 166, $3.00 in paper copy, $0.95 in microfiche. Completion Report, October 1970. 78 p, 16 tab, 7 ref, append. OWRR Project A-032-MISS (1).

Descriptors: *Ports, *Economics, *Water transportation, *Input-output analysis, Mississippi, Economic prediction, Income, Costs.
Identifiers: Earnings (Monetary), *Economic growth.

Overall economic growth for each of three Mississippi inland port counties was compared to the aggregate of all non-port counties for the period 1959-1968. The measures selected were total personal income, total earnings, farm earnings, nonfarm earnings and manufacturing earnings. The role of each Mississippi inland port in economic growth was analyzed first by comparing the growth rates for Mississippi inland ports to other inland ports on the Mississippi River System during the period 1959-1968; and second, by studying the changes in commodity groups handled by each Mississippi inland port during the study period. On intra-port analysis of each Mississippi inland port provided the basis for concluding that the existence of each port made on important contribution to economic growth. An analysis of the relative contribution of each port in 1968 to its repective regional economy was performed by constructing partial input-output tables for each port county.
W71-00473

PRELIMINARY WASTE WATER REPORT FOR THE OUTER AREA.
Northeastern Illinois Planning Commission, Chicago.
For primary bibliographic entry see Field 05D.
W71-00485

PRELIMINARY WASTE WATER PLAN FOR THE INNER AREA; SUPPLEMENT NO. 1, RECOMMENDED PLAN FOR DUPAGE COUNTY.
Northeastern Illinois Planning Commission, Chicago.
For primary bibliographic entry see Field 05D.
W71-00486

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

APPLICATION OF COMPUTERIZED OPERATIONS RESEARCH TECHNIQUE FOR OPTIMUM ECONOMIC SIZING OF THE MIDDLE FORK EEL RIVER PROJECT,
California State Dept. of Water Resources. Advanced Techniques Section.
For primary bibliographic entry see Field 06A.
W71-00077

ALTERNATIVE DIGITAL COMPUTER APPLICATIONS TO EVALUATE LINKED WATER RESOURCES,
Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 04A.
W71-00088

SOCIO-ECONOMIC PROBLEMS IN WATER RESOURCE USE AND CONTROL - PRODUCTION FUNCTIONS AND SOCIAL COSTS,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W71-00166

REPAYMENT INTEREST RATES FOR WATER PROJECTS,
Utah State Univ., Logan.
Daniel H. Hoggan.
Water Resource Research Vol 6, No 3, p 683-689, June 1970.

Descriptors: *Reimbursable costs, *Cost sharing, Financial feasibility, Cost allocation, Economic evaluation, Benefits, Discount rate, Risks.
Identifiers: *Repayment interest rate, Subsidy, Coupon rate, Opportunity costs.

Federal government policy with respect to the repayment interest rate has not been uniform. This interest rate is used to repay reimbursable costs of water projects and is related to the financial feasibility of a project. Usually the government has based its repayment interest rates on coupon rates of long term government bonds. The lack of a consistent government policy on repayment interest rates has resulted in subsidies to lower paying interest uses, namely municipal and industrial water users. The author also criticizes the inequality between interest rates used in benefit-cost analysis and those of repayment on the assumption that money should be paid back at the same rate as it is advanced. He suggests in order to develop uniformity, the government must examine repayment interest rates in conjunction with cost sharing and reimbursement. (Siegenthaler-Rutgers)
W71-00280

INCENTIVE PRICING AND UTILITY REGULATION,
Michigan Univ., Ann Arbor.
John G. Cross.
Quarterly Journal of Economics, Vol LXXXIV, No 2, p 236-253, May 1970. 4 fig.

Descriptors: *Pricing, *Prices, Utilities, Economics, Resource allocation, Average costs, Profit, Costs.
Identifiers: *Incentive pricing, *Utility regulation, Economic inefficiency, Public control, X-efficiency, Regulatory lag.

The author contends that in recent years economists have been growing increasingly concerned that their analyses of monopolistic behavior have overlooked a major source of economic inefficiency. In the past, emphasis has been placed almost entirely on the allocation of resources. It is now becoming apparent that an equal weight ought to be placed upon the mechanism of production itself, for it is quite possible that in our economy, inefficiency through the sheer wasting of resources is at least as important as that due to the improper allocation and distribution of goods and services. The author contends that the elimination of lax management, outdated production methods, and sloppy cost-control procedures would make a substantial difference in the value of a firm's operations. This possibility raises a serious problem in the area of utility regulation since it suggests that an important form of inefficiency has not been subjected to public control. The author discusses a device whereby one might deal with this problem--incentive pricing. This article has relevance to improving the management of water utilities. (Loeb-Rutgers)
W71-00282

RISK ALLOWANCE IN ORIGINAL CAPITAL INVESTMENTS,
Virginia Polytechnic Inst., Blacksburg.
D. L. Michelsen, Jr., and J. R. Snead.
The Engineering Economist Vol 15, No 3, p 137-157, Spring 1970.

Descriptors: *Risks, *Uncertainty, *Economic evaluation, Taxes, Capital, Costs, Investment, Value, Profits, Optimization, Discount rate, Time, Decision-making, Income.
Identifiers: *Discounted cash flow, *Depreciation, *Reuse value, Present worth, Operational cash flow.

The object of this paper is to consider the risks involved in an original capital investment, and how an economic evaluation might be adjusted for these varying capital risks. Particular attention is given to the effect of taxes and the adjustment of original capital risk as a function of potential reuse should the investment fail. A number of illustrations are given in order to indicate the original capital investment for risk. To give a better measure of risk capital the authors propose: (1) that the present worth of the guaranteed depreciation cash flow be discounted at the cost of capital and subtracted from the total initial investment, and (2) reducing the original risk capital by the amount of reuse value. The risks inherent in many water resource investments may be more effectively integrated into the economic evaluation through the use of these suggestions. (Murphy-Rutgers)
W71-00296

WATER AND SEWER FINANCIAL PLAN.
Chatham County-Savannah Metropolitan Planning Commission, Savannah, Ga.

Available from NTIS as PB-190 220, $3.00 in paper copy, $0.95 in microfiche. November 1969. 51 p.
Identifiers: *Urban planning, *Georgia, *Water supplies, Economics, *Economics, Sanitary engineering, Water pollution, Control, Sewage, Purification, Law, Construction, Population, Costs, Feasibility studies, Maps, *Chatham County (Ga), Sewage treatment, Taxes.

The Plan is a guide for financing needed improvements. The Plan recommends that Chatham County take over the responsibility for providing water and sewerage to the more densely developed portions of the County. The sewage treatment facilities to be financed by General Obligation Bonds backed by a countywide ad valorem tax, the sewage collection systems and water systems to be financed by Revenue Bonds backed by user charges. The Plan also presents an alternate method of financing, where communities wish to retain their own water and sewage collection systems. With this method, Chatham County would provide sewage treatment facilities financed by General Obligation Bonds backed by a countywide ad valorem tax, and Sewer Service Districts or municipalities to finance sewage collection systems through the use of property taxes or user charges, and that water system improvements be financed by currently operating water agencies.
W71-00422

6D. Water Demand

DEVELOPMENT OF WATER RESOURCES IN APPALACHIA - PART I, SUMMARY REPORT.
Corps of Engineers, Cincinnati, Ohio. Office of Appalachian Studies.
For primary bibliographic entry see Field 06B.
W71-00051

GEOBOTANIC APPROACH FOR IMPROVEMENT OF RANGE RESOURCES IN DESERT AND SEMI-DESERT AREAS OF KAZAKHSTAN, USSR,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 03B.
W71-00146

STUDY OF WATER RESOURCES IN THE CHAD BASIN.
United Nations Educational, Scientific and Cultural Organization, Paris (France).

Nature and Resources, Vol 6, No 2, p 6-11, June 1970. 1 fig.

Descriptors: *Reservoir storage, *Water table, *Groundwater, *Watersheds (Basins), *Water resources, *Model studies, Mapping, Tracers, Water balance, Water levels, Water analysis, Planning, Hydrologic data, Hydrologic budget, Aquifers, Evaporation, Semiarid climates, Analog models.
Identifiers: *Africa, *Lake Chad, Chad basin.

The Chad basin is a closed hydrological system containing Lake Chad and a vast reservoir of groundwater. Four countries (Cameroon, Niger, Nigeria and Chad) with high population growth rates lie on the shores of the lake. A study conducted by the United Nations was designed to inventory water resources and discover hydrological mechanisms and relationships so that an integrated water policy might be planned by the nations involved. Tracer studies revealed no clear relationships between Lake Chad and the surrounding aquifers. A cartographic survey was made and maps were constructed on scales ranging from 1:50,000 to 1:5,000,000. Finally, an electric analog model was constructed to calculate the effects of drawoff on groundwater levels. The results were: (1) There is an almost uninterrupted water-table over 1,400,000 square kilometers, but with certain topographic anomalies; (2) An artesian aquifer may be present all around the lake, overlaying a second and deeper aquifer, but there is practically no recharge, thus calling for prudent use; (3) Surface water is much more plentiful than ground water; (4) Overall water balance figures show that evaporation totals over two-thirds of the output. (Casey-Arizona)
W71-00161

LINEAR PROGRAMMING MODEL FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
Micha Gisser.
Available from NTIS as PB-194 785, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, July 1970. 13 p, 1 fig, 1 tab. OWRR Project No. 3109-33-A-022 N Mex (1).

Descriptors: *Water demand, *Systems analysis, *Economic prediction, *Planning, *Semiarid climates, Irrigation, Crops, Water allocation (Policy), Water costs, Water utilization, Water values, Semiarid climates, Model studies, Estimating equations, Linear programming, Constraints, Irrigation water, Agriculture.
Identifiers: *Pecos River Basin, Water importation.

A linear programming model of agricultural demand for imported water was developed for the Pecos Basin. The model utilizes agricultural activities and obtains agricultural demand functions for differing imported water prices and for local water use constraints. A constraint (L) indicates the highest per acre quantity of irrigation water farmers are allowed to use. The types of constraint incorporated into the model were salinity, legal, vegetables (greater than 20 percent production leads to oversupply), acreage and cotton (allotments). The basic assumptions of the model were: (1) Agricultural production can be divided into separate independent activities, (2) Each activity is governed by constant return to scale and fixed proportions, (3) Activities are divisible. The demand results are shown for L—3 at various local and imported water prices. (Casey-Arizona)
W71-00165

WATER SUPPLY AND WATER POLLUTION CONTROL-APPENDIX D TO REPORT FOR DEVELOPMENT OF WATER RESOURCES IN APPALACHIA.
Federal Water Quality Administration, Cincinnati, Ohio. Ohio Basin Region.
For primary bibliographic entry see Field 05G.
W71-00225

COOLING TOWERS - A TECHNOLOGICAL TOOL TO INCREASE PLANT SITE POTENTIALS,
Marley Co., Kansas City, Mo.
For primary bibliographic entry see Field 05D.
W71-00237

WATER FOR HOUSTON,
Turner, Collie and Braden Co., Inc., Houston, Tex.
Cecil H. Allen.
In: Water Resources Bulletin, Vol 6, No 2, p 189-192.

Descriptors: *Management, *Water distribution (Applied), *Water demand, *Water supply, Water sources, Industrial water, Municipal water, Groundwater, Surface runoff, Water quality, Engineering, Economics.
Identifiers: *Houston, Texas.

Houston, the Nation's sixth largest city, is taking appropriate steps to assure an adequate water supply to meet its municipal and industrial demands through the year 2000. A three-phase study entitled 'A Comprehensive Study of Houston's Municipal Water System' will be used as a master plan for both the domestic supply and the distribution system. Houston's situation is unusual because it now relies on groundwater sources for 80 percent of its domestic water supply, but must convert this system to depend on surface water for 60 percent of its total supply source. Problems concerning the conversion are complex. Surface water is more costly. Reservoirs that meet the plans and standards of state and federal water authorities as well as conveyance and treatment facilities must be developed. The total groundwater withdrawal rate must be increased but at the same time shifted from one area to another because of subsidence problems. Solutions to these problems require careful engineering study as well as economic and sociological planning. The plan calls for operation of three water treatment plants linked to the distribution system by means of low-pressure arterial mains which in turn will supply booster pump stations located throughout the city. The low pressure groundwater supply will be linked to the low pressure surface water supply allowing for controlled dependence on each water source according to seasonal conditions. (Marriott-Chicago)
W71-00315

A MUNICIPAL WATER DEMAND MODEL FOR THE CONTERMINOUS UNITED STATES,
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 06A.
W71-00324

ESTIMATED WATER USE IN FLORIDA, 1965,
Geological Survey, Washington, D.C.
R. W. Pride.
Florida Bureau of Geology Map Series 36, Department of Natural Resources, 1970. 1 sheet, 1 fig, 1 map, 1 tab, 5 ref.

Descriptors: *Water utilization, *Public utilities, *Irrigated land, *Nuclear powerplants, Industrial water, Florida, Hydrologic data, Water types, Saline water, Non-consumptive use.
Identifiers: *Hydrologic atlas, *Water use inventory.

Major uses and types of water are shown by color bars on a map scaled 1 inch equals 30 mi. The map report portrays where the largest quantities of fresh water for each major category of use are withdrawn. Estimates are given of the quantity of saline water circulated through thermoelectric power generating plants for cooling, 75% of which is from surface sources. Trends in water use, based on five-year estimates since 1950, are shown graphically, and a table gives total water use by type of use and source. Irrigation showed the most significant increase of the types of water use for the 1960-65 period. During 1965, 510,000 acre-ft of surface water and 650,000 acre-ft of groundwater were used on 490,000 acres of citrus crops; 260,000 acres of truck crops required 540,000 acre-ft of surface and 250,000 acre-ft of groundwater; and 500,000 acres of sugar cane, pasture and other crops were irrigated with 1,170,000 and 420,000 acre-ft, respectively, of surface and groundwaters. (Lang-USGS)
W71-00376

WATER OF THE WORLD AND ITS FUTURE,
Akademiya Nauk SSSR, (Moscow).
For primary bibliographic entry see Field 06B.
W71-00398

ADIRONDACK POWER AND LIGHT CORP V CITY OF LITTLE FALLS (RIPARIAN RIGHT TO UNALTERED RIVER'S FLOW).

148 Misc 191, 265 NYS 567-596 (1930).

Descriptors: *New York, *Riparian rights, *Natural flow doctrine, *Alteration of flow, Riparian land, Riparian waters, Competing uses, Diversion, Electric power, Municipal water, Obstruction to flow, Reasonable use, Relative rights, Judicial decisions, Rivers, River flow, Flow, Regulation, River regulation, Dams, Reservoirs, Water consumption, Consumptive use, Water utilization, Cities.

Plaintiff utility, a riparian landowner, brought an action against defendant municipality for damages caused by diversion of a river's waters from plaintiff's power plants. Plaintiff also sought an injunction to restrain such diversion. Plaintiff contended that as a riparian owner, it had the right to the river's flow past its premises in its natural course without diminution or obstruction thereto. Defendant contended that it had been granted the right to divert the waters of the river for consumptive municipal purposes by plaintiff's predecessor in title. The court construed the grant-in-title and held that defendant's right was subject to the restriction that it maintain the normal and natural flow of water by the use of regulatory reservoirs. Defendant had failed to construct and use such reservoirs, and consequently the conditions of the grant had not been met. Therefore, defendant was liable in damages to plaintiff for diverting the river's waters. Furthermore, such diversion constituted a continuing trespass upon plaintiff's water rights for which an injunction would lie. (Snow-Florida)
W71-00521

6E. Water Law and Institutions

FLOOD DAMAGE ABATEMENT-FEDERAL ASSISTANCE TO LOCAL GOVERNMENT.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 06F.
W71-00002

REPORT OF THE UNITED STATES DELEGATION TO THE SIXTH SESSION OF THE COORDINATING COUNCIL OF THE INTERNATIONAL HYDROLOGICAL DECADE, UNESCO GENEVA, SWITZERLAND, JULY 6-11, 1970.

International Hydrological Decade-UNESCO Report of 6th Session Coordinating Council, Geneva July 6-11, 1970. 22 p, 2 append.

Descriptors: *International Hydrological Decade *Conferences, Programs, Project planning Hydrology, Research and development, Projects Scheduling, United Nations.
Identifiers: UNESCO.

The report of the U. S. Delegation to the 6th session of the Coordinating Council of the International Hydrological Decade, UNESCO, presented. Most of the Sixth Session of the Council was devoted to discussions of the working group which are to be operative during the final half of the International Hydrological Decade. The U

Delegation went to the Sixth Session hoping to influence the Council to (1) reduce the number of working groups, and (2) simplify their terms of reference to include only priority items which can be achieved during the last half of the Decade. The Delegation was not successful in achieving either one of these objectives to a significant degree. (K-napp-USGS)
W71-00048

BRESHERS V NINETEENTH LA LEVEE DIST (DAMAGES RECOVERABLE FOR INJURY CAUSED BY LEVEE CONSTRUCTION).

65 So 494 (La Ct App 1936).

Descriptors: *Louisiana, *Eminent domain, *Compensation, *Levees, Judicial decisions, Legal aspects, Drainage, Cultivated lands, Land tenure, Leases, Damages, Drainage effects, Crops, Real property, Administrative agencies.

Plaintiff sought to recover damages for the destruction of his growing crops caused by the construction of a levee by defendant levee district. The court held that the Louisiana constitution allows compensation for lands and improvements actually used or destroyed for levee purposes, but no such compensation is allowed for the destruction of growing crops. Consequently, the trial court's judgment for defendant was affirmed. (Price-Florida)
W71-00053

WHEATLEY V CITY OF FAIRFIELD (DAMAGES CAUSED BY IMPOUNDED WATERS).
10A
264 NW 906-915 (Iowa 1936).

Descriptors: *Iowa, *Condemnation, *Flood damage, *Impounded waters, Administrative decisions, Boundaries (Property), Community development, Eminent domain, Judicial decisions, Land tenure, Legal aspects, Local governments, Proprietary power, Public rights, Riparian land, Riparian rights, Relative rights, Watercourses (Legal), Damages, Flooding, Impoundments, Dams, Reservoirs, Streams, Adjudication procedure, Remedies.
Identifiers: *Res judicata.

Defendant city erected a dam downstream from plaintiff's property. Water impounded thereby flooded plaintiff's land. Plaintiff brought action for damages and equitable relief. Before the case reached trial, defendant initiated condemnation proceedings against the flooded portion of plaintiff's land. The two suits were consolidated for trial. In the condemnation proceedings, plaintiff offered proof only as to the before and after value of the land, and was granted an award based thereon. The judgment directed defendant to pay the award or be enjoined from any use of the dam and the waters impounded thereby. Defendant then abandoned the condemnation proceeding and drained plaintiff's land. Plaintiff then sought an award for depreciation in rental value and damages to the land caused during the 3 year period in which defendant operated the dam. The court held that the issue of damages was res judicata in that an adjudication is final not only as to the matter actually determined, but as to every other matter the parties might have litigated which was essentially connected to the subject matter of litigation. Plaintiff's failure to prove these damages at trial barred any further action. (Clarke-Florida)
W71-00056

CITY OF CORAL GABLES V CRANDON (ESTABLISHMENT OF WATER CONSERVATION DISTRICT).

25 So 2d 1-3 (Fla 1946).

Descriptors: *Florida, *Cities, *Public benefits, *Water conservation, Municipal water, Local governments, State governments, Legislation, Water supply, Water table, Water yield improvement, Water quality, Salinity, Water pollution, Saline water, Infiltration, Saline water intrusion, Legal aspects, Judicial decisions, Water policy, Water management (Applied).

Plaintiff city brought action to enjoin the enforcement of a state act relating to the creation of water conservation districts in counties having a population of greater than 260,000. Plaintiff argued the act should be struck down since it was in effect a local law in that only Dade County contained such a large population. Plaintiff contended that such a law was invalid under the Florida constitution. The supreme court rejected the contentions, holding that the law had a reasonable basis in the subject regulated. The court took judicial notice of the fact that several other counties were approaching the 260,000 mark. The court also recognized that providing an ample supply of fresh water in Dade County had become a serious problem with population increases, increased consumption, excessive runoff problems and salt water invasion of fresh water areas. The object of the statute to restore fresh water levels was not prohibited by any constitutional barriers. (Hubener-Florida)
W71-00062

JEFFERSON REALTY CO V BD OF COMM'R OF EVERGLADES DRAINAGE DIST (VALIDITY OF DRAINAGE DISTRICT TAXES ON SOVEREIGN LANDS).
23 So 2d 274-276 (Fla 1945).

Descriptors: *Florida, *Ownership of beds, *Taxes, *Land reclamation, Meanders, Beds, Assessments, Land use, Land tenure, Land classification, Drainage districts, Land development, Boundaries (Property), Legal aspects, Judicial decisions, Lakes, Legislation, State governments, Local governments, Relative rights.
Identifiers: *Sovereignty lands.

In 1925 the Trustees of the Internal Improvement Fund conveyed to plaintiff's predecessor in title certain sovereignty lands underlying Lake Okeechobee. The state contracted with the vendee for the reclamation of the lands, which was accomplished by 1935. In 1927 and thereafter the county tax assessor placed the lands on defendant drainage district's tax rolls and made certain assessments. Plaintiff declined to pay such assessments, and brought suit to determine their validity. Defendant contended that on reclamation the lands became subject to taxation pursuant to an omnibus clause in a state act authorizing drainage district taxes on 'all other lands', i.e. lands not falling within certain prescribed categories in drainage districts. The Florida Supreme Court, in holding for plaintiff, stated that no basis existed for taxing the reclaimed lands. The omnibus phrase applied to land remote from drainage works and not to sovereignty lands below the meander line of the lake. (Hubener-Florida)
W71-00074

IDEAL FARMS DRAINAGE DIST V CERTAIN LANDS (PUBLIC POLICY ON DRAINAGE DISTRICT ASSESSMENTS).

19 So 2d 234-240 (Fla 1944).

Descriptors: *Florida, *Drainage districts, *Taxes, *Assessments, Public benefits, Public health, Social aspects, Legal aspects, Judicial decisions, Canals, Ditches, Dams, State governments, Local governments, Legislation, Swamps, Marshes, Overflow, Relative rights, Adjudication procedure.

Plaintiff drainage district brought suit to foreclose a lien for drainage taxes. Defendant interposed a defense of a three year statute of limitations on the theory that the tax was a liability created by statute. The trial court held for defendant and the supreme court affirmed. On rehearing the supreme court reversed. The court held that the state had the power to authorize or require local improvements to promote public health and welfare and to provide for canals, drains and drainage districts to implement such purposes. Where one statute provided that delinquent taxes constituted a lien until paid and another provided that actions on liens must be brought within three years, it was the court's duty to define a reasonable field of operation for the statutes, to harmonize them and to effect legislative purposes. Since laws affecting public policy and general welfare should be given liberal construction, the court held the three year limitation inapplicable in the instant case. (Hubener-Florida)
W71-00075

REALTY OPERATORS, INC V STATE MINERAL BD (OWNERSHIP OF LAKE BED).
202 La 398, 12 So 2d 198-203 (1942).

Descriptors: *Louisiana, *Ownership of beds, *Patents, *Navigable waters, Non-navigable waters, Lakes, Land tenure, Leases, Exploitation, Mineralogy, Legislation, Legal aspects, Judicial decisions, State governments, Surveys, Beds under water, Land reclamation, Relative rights, Boundaries (Property), Administrative agencies, Remedies.

Plaintiff sought an injunction to prevent the State Mineral Board from granting a mineral lease to the bed of a certain lake. Plaintiff claimed ownership of the lake and its bed by patents acquired at a sheriff's sale. Plaintiff averred that the lake was non-navigable and that it had enjoyed possession of such lake for 20 years. Defendant contended that the lake had formerly been navigable and that title to the bed remained vested in the state and could not have been conveyed by the patents. The Louisiana Supreme Court affirmed the trial court's permanent injunction against issuance of the lease. The court treated the case as an action to establish title rather than protect possession. The court held that the patents covered the bottom of the lake in question. Defendant's right to question the validity of the patents had been foreclosed by failure to file suit within six years of the enactment of an act which made patents issued to beds of lakes or other waterbodies subject to annulment. (Hubener-Florida)
W71-00076

MISSISSIPPI STATE HIGHWAY COMM'N V HUDGINS (EVALUATION OF PROPERTY TAKEN BY CONDEMNATION).
181 So 719-720 (Miss 1938).

Descriptors: *Mississippi, *Condemnation value, *Compensation, *Evaluation, Eminent domain, Judicial decisions, Legal aspects, Reservoirs, Springs, Spring waters, Local governments, Real property, Property values, Administrative agencies, Condemnation.

In a condemnation proceeding by plaintiff commission, an award was granted to defendant which included not only an amount for the value of the property, taking into consideration that a spring fed into it, but also an additional amount for the alleged value of the spring. From this award, plaintiff appealed. The court held that in such a proceeding it is not proper, after awarding full damages for property taken, to then allow additional compensation for those things without which the property would have had a lesser value. Thus it was error to allow an additional amount for the value of the spring. The judgment was affirmed with remittitur. (Price-Florida)
W71-00079

MISSISSIPPI STATE HIGHWAY COMM'N V YELLOW CREEK DRAINAGE DIST (BRIDGE CONSTRUCTION ENJOINED AS BEING IN-

TERFERENCE WITH MAINTENANCE OF DRAINAGE DISTRICT).
180 So 749-752 (Miss 1938).

Descriptors: *Mississippi, *Drainage districts, *Bridge construction, *Competing uses, Eminent domain, Drainage, Drainage practices, Drainage programs, Drainage systems, Canals, Bridge design, Piers, State governments, Highways, Cultivated lands, Public benefits, Right-of-way, Easements, Obstruction to flow, Overflow, Judicial decisions, Legal aspects, Relative rights.

Plaintiff highway department sought to restrain defendant drainage district from interfering with the construction of a bridge by plaintiff across a canal which was part of a drainage system maintained by defendant. Plaintiff, in a cross-bill filed by defendant, was restrained from constructing said bridge. On appeal plaintiff alleged the bridge was being built in the same place a previous bridge had been, that it was being properly constructed and that it was causing no more obstruction in the canal than existed previously. Defendant alleged that the bridge was being improperly constructed and that increased obstruction to the canal would result due to plaintiff's placing of piers in the canal. The court confirmed the lower court's findings that the bridge as constructed would collect drift and damage agricultural land in the district. Both parties had powers of eminent domain. Defendant owned the right-of-way through which the canal ran. Property already devoted to public use may be again taken or damaged for public use if the public interest is served and the prior use is not materially impaired. Here, both public purposes, highway construction and the maintenance of drainage districts, could be served without significant damage to either if no piers were placed in the canal. The judgment for defendant was affirmed. (Price-Florida)
W71-00081

STATE V STOUTAMIRE (RIGHT OF PEOPLE TO TAKE FISH FROM PUBLIC WATERS OF THE STATE).
179 So 730-734 (Fla 1938).

Descriptors: *Florida, *Fish conservation, *Fishing, *Public rights, Legislation, State governments, Public benefits, Freshwater fish, Fish, Fish behavior, Judicial decisions, Legal aspects, Regulation, Supervisory control (Power), Relative rights.

The Florida legislature had passed a law prohibiting the taking of fish from a certain one half mile length of a fresh water river in Northwest Florida. Plaintiff, in a habeas corpus proceeding, contended that the law was local or special in nature and as such was invalid since its passage had failed to comply with Florida constitutional requirements pertaining to such laws. Defendant sheriff contended that the law was a general law. The court stated that the right of the state in the fish of public waters is a sovereign right of preservation, conservation and regulation, but not an absolute right such as the state has in its proprietary property. The people have a right to take fish from public waters subject to such regulation. The court held the statute in question was a special law, the passing of which had not met certain constitutional requirements. Consequently the statute was invalid and could not be enforced. (Price-Florida)
W71-00082

HENRITZY V HARRISON COUNTY (RIGHT OF WAY SECURED VIA CONDEMNATION FOR SEA WALL CONSTRUCTION).
178 So 322-327 (Miss 1938).

Descriptors: *Mississippi, *Sea walls, *Right-of-way, *Condemnation, Eminent domain, Local governments, Easements, Landfills, Compensation, Judicial decisions, Legal aspects, Legislation, Damages, Adjudication procedure, Washouts, Surveys.

Defendant had been required to remove a concrete structure from a right-of-way which had been secured by plaintiff county for the construction of a sea wall which was designed to protect a highway from storm damage. Defendant contended the condemnation proceeding through which the right-of-way had been secured had been unconstitutionally conducted. The court found that the procedure for condemnation had been followed properly, and that the statute of limitations was a bar to any claim for damages by defendant if he in fact had ever had a right to such claim. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-00083

STUART V DETROIT FINNISH COOPERATIVE SUMMER CAMP ASS'N (INTERFERENCE WITH WATER LEVEL).
277 Mich 144, 269 NW 122-124 (1936).

Descriptors: *Michigan, *Riparian rights, *Dams, *Water levels, Legal aspects, Judicial decisions, Water law, Backwater, Overflow, Water level fluctuations, Water, High water mark, Lakes, Obstruction to flow, Prescriptive rights, Reasonable use, Recreation, Natural flow doctrine, Competing uses, Relative rights, Riparian waters, Riparian land.

Defendant association's property surrounded a lake containing a spring whose waters flowed into a chain of small lakes some three-quarters of a mile distant. Plaintiffs, who owned land on the chain of lakes, built a dam which raised the level of defendant's lake 1 1/2-2 feet. When defendant began to construct a drain to lower the water level, plaintiffs brought action to enjoin such construction. Defendant then filed a cross-bill seeking to enjoin plaintiffs' maintenance of their dam so as to raise the water level of its lake. Defendant contended that plaintiffs could not construct a dam which interfered with defendant's enjoyment of its property. Plaintiffs contended that defendant was barred by laches because it allowed construction of the dam and subsequent development of surrounding property without complaint. The court held that plaintiffs had not acquired a prescriptive right to operate a dam because their dam had not been in existence the requisite period of years. Mere passivity by defendant, in the absence of a duty to speak, did not stop it from complaining when the actions of plaintiffs interfered with its enjoyment of its property. The court enjoined plaintiffs from raising the water in defendant's lake beyond its original level. (Dye-Florida)
W71-00084

CITY OF NEW LISBON V HAREBO (CONDEMNATION PROCEDURE FOR DAM CONSTRUCTION).
271 NW 659-664 (Wis 1937).

Descriptors: *Wisconsin, *Condemnation, *Eminent domain, *Local governments, Legislation, Judicial decisions, Legal aspects, Dams, Political aspects, Damsites, Backwater, Damages, Flow, Recreation, Public benefits, Public lands, Cities, Navigable waters, Artificial use, Rivers, Streams, Ponds, Lakes, Reservoirs, Permits.

Petitioner city sought to condemn property for construction of a dam and reservoir to be used as a recreational park. Respondent landowners demurred on the grounds that: (1) the public necessity for condemnation was not shown; and (2) the petition did not allege that a permit had been obtained for construction of the dam. Petitioner contended that a permit could not be obtained until the property to be flowed was acquired, since applicants for permits must show that no property damage will result from dam operation. The Supreme Court of Wisconsin ruled for respondent, stating that property damage contemplated by regulations governing issuance of permits is damage in time of flood, not normal flowage. Property may not be condemned until the public purpose for which it is being acquired is shown to be legal and imminent. Without a permit, construction of the dam would be illegal and the public purpose could not be effectuated. The court also found the petition defective in not alleging why it was necessary to condemn the particular property involved. (Dye-Florida)
W71-00085

WARREN V GEORGIA POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY BACKWATER FROM DAM).
197 SE 338-342 (Ga Ct App 1938).

Descriptors: *Georgia, *Hydroelectric plants, *Backwater, *Flood damage, Dams, Compensation, Damages, Remedies, Legislation, Condemnation, Eminent domain, Cultivated lands, Public utilities, Rivers, Drainage, Ditches, Silts, Sediments, Riparian land, Riparian rights, Public rights, Legal aspects, Judicial decisions, Adjudication procedure.
Identifiers: Nuisance.

Plaintiff landowner brought a nuisance action against defendant power company for damages to plaintiff's land allegedly caused by the backwater from defendant's dam. Plaintiff contended that defendant negligently operated and maintained the dam and caused the river to fill with silt and sediment, thereby impairing the drainage of plaintiff's land and rendering it unfit for cultivation and diminishing its rental value for the previous four years. Defendant contended that the evidence failed to disclose any negligence on defendant's part, and that the damage to plaintiff's land was permanent and had occurred more than four years ago; therefore, plaintiff's action was barred by the statute of limitations. Affirming a judgment of nonsuit, the court held that the evidence showed a taking and damaging of the property for public use rather than a continuing nuisance, but plaintiff could not recover the just compensation to which he was entitled for such a taking in a nuisance action. Further, the court noted that where damage is of a permanent nature, an action for continuing nuisance is improper and can be barred by the statute of limitations. (Liptak-Florida)
W71-00086

SATREN V HADER CO-OPERATIVE CHEESE FACTORY (ABATEMENT OF NUISANCE CAUSED BY DISCHARGE OF INDUSTRIAL WASTE).

279 NW 361-364 (Minn 1938).

Descriptors: *Minnesota, *Water pollution sources, *Pollution abatement, *Industrial wastes, Water pollution, Judicial decisions, Legal aspects, Legislation, Pollutants, Riparian rights, Wastes, Decomposing organic matter, Sewage, Streams, Dairy industry, Milk, Path of pollutants, Water pollution control, Water pollution effects, Abatement, Industrial plants, Industrial water.

Defendant operated a cheese factory, dumping sewage and whey into a creek which flowed adjacent to his property and through plaintiff's property. Plaintiff brought action to enjoin such dumping. A trial court adjudged the dumping a nuisance and enjoined defendant from dumping sewage and whey. On appeal, defendant contended that: (1) regulation of water pollution is the State Board of Health's responsibility, not the courts; and (2) plaintiff's damages ($63 a year) were too insignificant to warrant an injunction. Plaintiff contended that the statute giving the Board of Health authority over water pollution does not prevent the courts from abating private nuisances under prior statutes. The Supreme Court of Minnesota affirmed, ruling that the cheese factory had obtained no prescriptive right to dump whey because its dumping was neither continuous nor homogeneous for the required time period. The insignificance of the damage to plaintiff was immaterial to issuance of an injunction. However, only that activity which was shown to have been injurious to plaintiff, the

dumping of whey, could be enjoined. The trial court's injunction was modified to that effect. (Dye-Florida)
W71-00087

KELLOG V HOTTMAN (INTERFERENCE WITH FLOW OF FLOODWATERS).
286 NW 415-417 (Iowa 1939).

Descriptors: *Iowa, *Flood protection, *Flood routing, *Dikes, Judicial decisions, Legal aspects, Flood control, Diversion, Diversion structures, Levees, Flooding, Rivers, River flow, Floods, Floodwater, Running waters, Streams, Obstruction to flow, Alteration of flow, Arable land, Missouri River, Repulsion (Legal aspects).

Plaintiff's property was surrounded on three sides by dikes of his own construction which prevented the waters of the Missouri River from inundating his land in time of flood. On the fourth side ran an elevated road. Defendant landowners constructed a dike along a portion of this road, and at a somewhat higher level, for the purpose of diverting the course of floodwaters. Plaintiff complained that the new construction would raise the level of floodwaters around his property and would prevent waters which entered his property from escaping. A lower court denied plaintiff's request for an injunction restraining construction of defendant's dike. The Supreme Court of Iowa affirmed. The evidence did not support plaintiff's allegation of interference with the course of floodwaters around plaintiff's property. Plaintiff's dike had been sufficient to protect his land from flood waters for years and there was no proof of the possibility of an extraordinary flood in the foreseeable future. (Dye-Florida)
W71-00089

ARND V HARRINGTON (TITLE BY ACCRETION VERSUS TITLE BY ADVERSE POSSESSION).
287 NW 292-296 (Iowa 1939).

Descriptors: *Iowa, *Land tenure, *Accretion (Legal aspects), *Prescriptive rights, Boundaries (Property), Boundary disputes, Missouri River, Adjudication procedure, Judicial decisions, Jurisdiction, Rivers, Interstate rivers, Bank erosion, Evulsion, Real property, Water rights, Remedies, Legal aspects, Riparian land, Riparian rights, State jurisdiction.

Plaintiff and defendant both claimed title to land created by accretion along the Missouri River. Plaintiff sued defendant for trespass, asking for an injunction to prevent defendant's interference with his use of the land and for damages. Defendant cross-claimed to quiet title and also sought a similar injunction. Plaintiff claimed title by adverse possession. Defendant claimed title by accretion formed by the changing course of the Missouri River, and argued that the complaint erroneously described the land as being in Nebraska when it actually was located in Iowa. Affirming a judgment for plaintiff, the court held that the evidence clearly established title in plaintiff by adverse possession. As to the description of the land, the court found that there was no question as to the identity of the tract in controversy and, although state boundaries may change as a result of accretion, the court has jurisdiction as long as the land is actually within the state at the time and all the parties are before the court. (Liptak-Florida)
W71-00090

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'N (ADMINISTRATIVE ORDER TO SUPPLY WATER).
287 NW 682-683 (Wis 1939).

Descriptors: *Wisconsin, *Administrative decisions, *Community development, *Water supply, Equitable apportionment, Judicial decisions, Legal aspects, Local governments, Preferences (Water rights), Public benefits, Relative rights, State governments, Water rights, Public utilities, Public utility districts, Conduits, Remedies.

Defendant Public Service Commission entered an order granting authority to defendant Town of Greenfield to construct water mains which would ultimately allow the Town of Greenfield to obtain its water from defendant City of West Allis. Plaintiff City of Milwaukee brought this action to set aside said order, contending that it furnished water to the City of West Allis, and if the plans were carried out, the necessary water might ultimately be supplied by plaintiff. The court dismissed the action, holding that the mere construction of the water mains was no concern of the plaintiff. If and when the Public Service Commission ordered the City of West Allis to supply water to the Town of Greenfield, plaintiff would have standing to bring an action. (Clarke-Florida)
W71-00091

DETROIT TRUST CO V DINGMAN (AUTHORITY OF DRAINAGE DISTRICTS TO ALLOW INCIDENTAL SEWAGE DISPOSAL THROUGH DRAINAGE SYSTEM).
291 Mich 170, 289 NW 118-122 (1939).

Descriptors: *Michigan, *Drainage systems, *Drains, *Sewage disposal, Judicial decisions, Legislation, Legal aspects, Drainage, Subsurface drainage, Surface drainage, Drainage programs, Multiple-purpose projects, Surface waters, Drainage districts, Governments, Sewers, Conduits, Administration, Local governments, Sewage, Drainage water, Surface runoff, Drainage engineering, Drainage practices.

Drains disposing of surface water and sewage were constructed in a drainage district where plaintiffs were taxpayers. Plaintiffs sought an injunction restraining defendant drainage district from assessing drainage taxes to pay for construction of the drains on the grounds that the drainage structures were sewers and not within the authority of the drainage district to construct. The lower court ruled for plaintiffs. The Supreme Court of Michigan reversed, stating that a structure may retain its character as a drain though incidentally disposing of sewage. Testimony showed that the structure in the instant case were designed on the basis of the volume of runoff water flow and only incidentally to dispose of sewage. Michigan statutes allow the incidental use of drains for sewage disposal. Location of parts of the drain beneath the ground did not change its character. (Dye-Florida)
W71-00092

WHITE V WELSH (AUGMENTATION OF UTILITY CAPACITY).
291 Mich 636, 289 NW 279-281 (1939).

Descriptors: *Michigan, *Legislation, *Water supply, *Water sources, Judicial decisions, Legal aspects, Cities, Pipes, Lakes, Inter-basin transfers, Pipelines, Water conveyance, Water delivery, Public utilities, Facilities, Local governments, Administration, Conduits, Utilities, Water works, Water distribution (Applied), Regulation.

Plaintiff taxpayers sought to restrain defendant city of Grand Rapids from constructing a water pipe to Lake Michigan to transport water to the city's water system. Plaintiffs contended that the construction would violate a statute prohibiting acquisition by a city of a public utility without consent of the electors. The lower court dismissed the complaint, saying that the pipeline construction was an extension of an existing utility rather than the acquisition of a new one. The Supreme Court of Michigan affirmed, citing as authority a previous case in which a city was allowed to purchase a complete power plant to augment existing power sources. In the instant case the proposed construction was a pipeline whose only use was to be in conjunction with the existing city water system. Consequently, defendant had not violated the statute. (Dye-Florida)
W71-00093

KUEHN V VILLAGE OF MAHTOMEDI (CONFLICT BETWEEN PUBLIC AND PRIVATE OPERATORS OF WATER SYSTEMS).
292 NW 187-191 (Minn 1940).

Descriptors: *Minnesota, *Community development, *Local governments, *Public rights, Equitable apportionment, Human population, Judicial decisions, Legal aspects, Permits, Relative rights, Third party effects, Water transfer, Potable water, Pipes, Pipelines, Municipal water, Water supply, Water distribution (Applied).
Identifiers: *Dedication, *Negligence.

Plaintiff constructed a water plant and pipes for the purpose of selling water to private customers. Several years later, defendant village of Mahtomedi was incorporated, following which defendant constructed its own water plant and lines, many of which paralleled plaintiff's. Plaintiff sued for damages, alleging three grounds: (1) the mere establishment of his water system constituted a perpetual franchise by statute; (2) a plat describing a dedication of a section of the town reserved to him the exclusive right to lay and maintain water pipes in that section; and (3) defendant negligently damaged his pipes. The court held as to the first contention that the statute in question concerned the use of public roads for enterprises developing water power. Plaintiff's business of selling water was not included within the scope of the statute. Secondly, the court held that a dedicator of land may not attach to the dedication limitations which remove the land from public control. Such limitations are void as against public policy. As to the third contention, the statute of limitations for filing negligence actions against a municipality had run. (Clarke-Florida)
W71-00094

VANDREUIL LUMBER CO V EAU CLAIRE COUNTY (CONDEMNATION OF FLOWED LANDS).

239 Wis 538, 2 NW2d 356-362 (1942).

Descriptors: *Wisconsin, *Eminent domain, *Dams, *Condemnation, Judicial decisions, Legal aspects, Legislation, Recreation, Reservoirs, Taxes, Governments, Federal government, Local governments, Government finance, Flow, Flooding, State governments, Administration, Administrative decisions, Real property.

Defendant county constructed a dam which, in operation, flowed plaintiff corporation's property. Subsequent to the dam's construction, a statute was enacted empowering the county to condemn property which was to be flowed by dams constructed under county-sponsored work projects. Plaintiff objected to the condemnation of its land because: (1) enactment of the condemnation statute was after construction of the dam which flowed its land; and (2) administrative requirements for condemnation had not been fulfilled. Defendant contended that the statute applied to any dam, regardless of when constructed. The Supreme Court of Wisconsin found for defendant, and held that all procedural requirements for condemnation had been compiled with. The fact that defendant was acquiring some flowed lands by lease did not require it to acquire all land that way. A county may use whatever means it deems most efficient to acquire flowed lands. (Dye-Florida)
W71-00095

LAGE V POTTAWATTAMIE COUNTY (FLOOD DAMAGE RESULTING FROM PUBLIC ACTIVITY).
5 NW2d 161-167 (Iowa 1942).

Descriptors: *Iowa, *Flooding, *Eminent domain, *Local governments, Judicial decisions, Legislation, Legal aspects, Flood damage, Condemnation, Dikes, Banks, Highways, Embankments, Road-

banks, Drains, Levees, Drainage districts, Governments, State governments, Floods, Cost allocation, Property values, Land forming, Compensation.

Plaintiff's property was damaged by intermittent flooding caused by defendant county's cutting of the banks and dikes of a drainage ditch. The bank cutting was done in the course of the purchase of fill dirt from plaintiff by defendant for the purpose of raising the level of a state highway which ran adjacent to plaintiff's property. Plaintiff alleged that the flooding of his property was a taking by government of his property without just compensation. Plaintiff claimed to be entitled to the value of his property before flooding. The Supreme Court of Iowa held that where a public structure necessarily leads to the flooding of private land, there is a taking of property requiring compensation. That defendant was performing a duty in improving the highway did not relieve defendant of responsibility. Payment for the fill dirt did not contemplate further damage to plaintiff's property and was not compensation for such damage. (Dye-Florida)
W71-00096

CITY OF MILWAUKEE V PUBLIC SERVICE COMM'M (PUBLIC UTILITIES REGULATION).
5 NW2d 800-804 (Wis 1942).

Descriptors: *Wisconsin, *Public utilities, *Local governments, *Water supply, Judicial decisions, Legislation, Legal aspects, Governments, Utilities, Public utility districts, Water distribution (Applied), Administration, Institutions, Regulation, Water works, Water rates, Cities, Water demand, Water management (Applied), Administrative agencies, Administrative decisions.

Plaintiff city operated a water works utility. By contract with defendant town the city agreed to supply water to a limited portion of the town. Defendant Public Service Commission ordered the city to extend service to the remainder of the town on the theory that by servicing part of the town it had become a utility for the entire town under the direction of the Commission. The trial court held for the Commission. The Supreme Court of Wisconsin reversed. The issue was whether a municipal utility, by accepting a contract to service a limited area of a town, becomes a utility for the entire town. Plaintiff, by extending its service, became a utility outside the city only to the extent of its contract. Plaintiff could be required to continue to service the area contracted for, but could not be required to extend its services to the entire town. (Dye-Florida)
W71-00098

STATE EX REL PETERSON V BENTLEY (COMPENSATION FOR TAKING OF PRIVATE PROPERTY REQUIRED).
12 NW2d 347-359 (Minn 1943).

Descriptors: *Minnesota, *Eminent domain, *Compensation, *Flooding, Condemnation, State governments, Governments, Legislation, Judicial decisions, Legal aspects, Political aspects, Dams, Jurisdiction, State jurisdiction, Flow, Reservoirs, Standing waters, Backwaters, Administration, Administrative decisions, Damages, Flood damage, Dam construction.

Petitioners sought to intervene in a suit brought by the state to condemn lands to be used for a dam and reservoir. Petitioners claimed that their land would be flooded by the proposed dam to the extent of a taking by the state, and sought just compensation for the property. The state claimed that petitioners were improper parties to the action. The Supreme Court of Minnesota found for petitioners. The state may take private lands only for a public use and only after paying just compensation. Flooding of private property is a taking and requires compensation. The amount of compensation is a judicial question. It is immaterial that insufficient funds were appropriated by the legislature to compensate petitioners. Compensation must be made. The court in its discretion may allow petitioners to intervene even though they have not fulfilled the requirements of the intervention statute. Where the state has not changed its position in reliance on petitioners' inaction, laches does not apply. (Dye-Florida)
W71-00106

MCCAULEY V SALMON (RELATIVE RIGHTS OF RIPARIAN OWNERS AND THE PUBLIC ALONG NAVIGABLE WATERS).
14 NW2d 715-716 (Iowa 1944).

Descriptors: *Recreation, *Iowa, *Riparian rights, *Navigable waters, Judicial decisions, Navigable rivers, Bodies of water, Rivers, Streams, Boundaries (Property), River beds, Ownership of beds, Riparian waters, Legal aspects, Streambeds, Boats, Boating, Water sports, Reasonable use, Competing uses, Relative rights, Riparian land, Watercourses (Legal), Navigation.

Defendants operated motorboats on a river. Plaintiff owned lands along the river and sought to enjoin as a nuisance the operation of boats on the river with unreasonable noise and at high speeds. The river adjacent to plaintiff's property was a navigable stream deepened by a dam constructed with the consent of riparian owners. Its primary use was recreational and boats operating on the river were licensed by the state. The trial court granted relief as to noise but not as to speed. The Supreme Court of Iowa affirmed. Riparian owners own only to the high water marks of navigable streams. The right of the public to navigate such streams is paramount, including rights of boating and other sports. The shores are subject to dangers incident to reasonable exercise of the navigation right. Damages resulting from such reasonable navigation must be borne by the owners of riparian land. So long as boats navigating the river did not exceed the statutory speed limit, no regulatory action would be taken. (Dye-Florida)
W71-00109

JOHNSON V STARR (NEGLIGENT DAM CONSTRUCTION).
191 SE 874-875 (Ga Ct App 1937).

Descriptors: *Georgia, *Dam failure, *Flood damage, *Impounded waters, Dams, Storm drains, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Relative rights, Riparian land, Riparian rights, Riparian waters, Streams, Remedies, Damage, Overflow, Flooding, Construction, Dam construction.

Defendant constructed an earthen dam across a stream flowing through his land. There were no storm drains installed therein. During a heavy rain, the dam collapsed. Plaintiff claimed that his land was flooded by the overflow of the stream caused by the breaking of the dam, and brought action to recover for damages caused by such flooding. Defendant admitted all the facts but contended that plaintiff's land was already flooded when the dam broke. The trial court placed the burden of proof on defendant as to his nonnegligence in constructing the dam. The appellate court reversed, holding that the burden was on plaintiff to sustain his allegations of negligence. (Clarke-Florida)
W71-00126

FINSETH V SPERRY (MAINTENANCE OF DRAINAGE SYSTEMS).
17 NW2d 499-502 (Minn 1945).

Descriptors: *Minnesota, *Drainage districts, *Cost allocation, *Local governments, Judicial decisions, Legal aspects, Legislation, Drains, Costs, Cost sharing, Maintenance costs, Financing, Drainage, Governments, Ditches, Drainage systems, Taxes, Obstruction to flow, Repairing, Administration, Management, Operation and maintenance, Maintenance.

Plaintiffs were owners of land drained by one of eleven branches of a judicial ditch system. The drain became obstructed by soil and vegetation. Plaintiffs sought to have the ditch cleaned by defendant drainage district under a statute obligating drainage districts to clean and repair their facilities on petition when the cost of such maintenance is less than 30 per cent of the cost of construction. Defendant contended that such maintenance was required only to benefit the entire system, not when a small part of the system needed repair. The Supreme Court of Minnesota held for plaintiffs. If defendant lacked sufficient funds to maintain the drain, plaintiffs were entitled to have the cost of cleaning and repairs assessed against all property within the district in the same proportion as costs of the original construction. The county board was obligated to keep in repair and unobstructed the entire judicial ditch system of the county. (Dye-Florida)
W71-00147

POOVEY V CITY OF HICKORY (CITY'S LIABILITY FOR WATER POLLUTION RESULTING FROM SEWAGE DISPOSAL).
210 NC 630, 188 SE 78-81 (1936).

Descriptors: *North Carolina, *Water pollution, *Compensation, *Sewage disposal, Remedies, Streams, Sewage, Adjudication procedure, Legal aspects, Local governments, Cities, Judicial decisions, Riparian rights, Waste disposal, Eminent domain, Condemnation, Municipal wastes, Water pollution control, Water quality, Water quality control, Treatment facilities.

Plaintiff landowner brought an action for nuisance and to recover damages from defendant city as a result of defendant's practice of dumping raw sewage into a creek which ran through plaintiff's property. Plaintiff contended that defendant's sewage disposal plant was wholly inadequate for the city's expanded population and asked for an injunction restraining defendant from operating the inadequate plant after a reasonable time. Plaintiff further sought damages for temporary injury to her property as well as for permanent injury, claiming a taking of her property under defendant's eminent domain powers. Defendant contended that the complaint was improper and moved to strike all references to defendant's increased population and financial ability as irrelevant and prejudicial. Reversing an order granting defendant's motion, the court held that, since defendant admitted the truthfulness of the allegations, it could not be said as a matter of law that the truth was irrelevant or prejudicial to defendant's case. The court also noted that it was entirely proper for plaintiff to seek to abate a nuisance in the same action in which damages were sought. (Liptak-Florida)
W71-00162

SINK V CITY OF LEXINGTON (LIABILITY FOR DAMAGE CAUSED BY BACKWATER FROM MUNICIPAL DAM).
214 NC 548, 200 SE 4-5 (1938).

Descriptors: *North Carolina, *Dams, *Backwater, *Flood damage, Natural flow doctrine, Riparian land, Riparian rights, Riparian waters, Water rights, Public rights, Remedies, Adjudication procedure, Judicial decisions, Legas aspects, Local governments, Watercourses (Legal), Ditches, Drainage effects, Drainage water, Surface drainage, Municipal water, Public utilities, Reasonable use, Cultivated lands, Beneficial use.

Plaintiff farmer brought action against defendant city and city utility commission for damages to his land resulting from the construction of a dam as part of the municipal water system. The backwater of the dammed creek reached to within 600 feet of plaintiff's farm which was located above the reservoir. Plaintiff contended that prior to the dam construction, a creek had provided drainage for his property, allowing him to use the land for cultivation and pasture, but that since the dam construc-

tion the land could not drain, was usually standing in water and was therefore unfit for cultivation. Defendant denied liability. Revising a judgment of nonsuit, the court held that plaintiff's evidence was sufficient to have the case submitted to the jury. The court noted that a riparian owner has a right to have the streamflow maintained as its natural flow and to use the water for domestic, manufacturing and other purposes subject only to the equal rights of beneficial use of other riparian owners. (Liptak-Florida)
W71-00206

SILAS MASON CO V TAX COMM'N OF WASHINGTON (STATE'S RIGHT TO TAX FEDERAL GOVERNMENT'S CONTRACTORS).
302 US 186, 58 Sup Ct 233-245 (1937).

Descriptors: *Washington, *Taxes, *Federal reclamation law, *Federal jurisdiction, Grand Coulee Dam, Columbia River, State jurisdiction, Legislation, Permits, Regulation, Judicial decisions, Governments, Federal government, State governments, Legal aspects, Contracts, Navigable rivers, Ownership of beds, Damsites, Dam construction, United States.
Identifiers: *Reclamation Act.

Plaintiff contractors brought suit to restrain the enforcement of the Occupation Tax Act of the State of Washington as applied to gross income they received for work performed in connection with the building of the Grand Coulee Dam on the Columbia River. The Washington supreme court upheld the tax and plaintiffs appealed. The United States Supreme Court stated that the questions presented were whether the tax imposed an unconstitutional burden on the federal government and whether the areas in which plaintiffs' work was performed were within the exclusive jurisdiction of the United States. The Supreme Court held that the tax did not impose an unconstitutional burden. The Court also held that the acquistion title to land for construction of the dam did not confer exclusive jurisdiction upon the United States unless the state had also transferred all residual jurisdiction to the United States. The state could retain jurisdiction over the areas owned by the United States for purposes not inconsistent with federal functions and could tax certain activities which Congress had permitted to remain subject to state licenses, permits and building and health regulations. (Hubener-Florida)
W71-00213

UNITED STATES V FLOWER (DISPUTE TO LAND CREATED BY AVULSION).

108 F2d 298-302 (8th Cir 1939).

Descriptors: *Iowa, *Nebraska, *Avulsion, *Accretion (Legal aspects), Bank erosion, Boundaries (Property), Boundary disputes, Rivers, Alluvium, Missouri River, Meanders, River beds, Ownership of beds, River flow, Riparian rights, Relative rights, Legal aspects, Judicial decisions, Federal government, Federal jurisdiction, Indian reservations, United States.

The United States brought suit on behalf of the Winnebago Indian Tribe to recover 4000 acreas of and which lay in the Missouri River bottom. Defendant contended that an avulsive action in the 1870's had caused the main channel of the river to shift towards Iowa, leaving land originally in Iowa on the Nebraska side of the river. Because of this avulsive change, defendant maintained that the and between the old and the new channels would remain part of Iowa. Plaintiff claimed title to the and as accretions to its holdings in Nebraska. The Court of Appeals, Eighth Circuit, affirmed the district court's holding that the western boundary of Iowa would remain in the middle of the channel of the Missouri River as of the time Iowa was admitted to the Union. Thus the land separated from Iowa by avulsion in the 1870's remained part of Iowa. The court held, however, that government was entitled to claim land forming the former channel bottom up to the middle of the former channel. (Hubener-Florida)
W71-00234

BD OF LEVEE COMM'RS FOR YAZOO-MISSISSIPPI DELTA V WITHERS (CONDEMNATION AND RIGHT TO CONSEQUENTIAL DAMAGES).
6 So 2d 115-117 (Miss 1942).

Descriptors: *Mississippi, *Levees, *Riparian land, *Condemnation, Condemnation value, Local governments, Dams, Embankments, Judicial decisions, Legal aspects, Relative rights, Flood control, River regulation, Compensation, Prescriptive rights, Land tenure, Riparian rights, Eminent domain, Discharge (Water), Seepage.

Plaintiff board sought to condemn a parcel of land owned by defendants which constituted part of a pond covering about 10 acres. Plaintiff had previously constructed a holding dam on its own property which caused the creation of the pond. The holding dam was to be abandoned and the pond water released. Defendants, who had enjoyed fishing and boating privileges in the pond, demanded consequential damages be awarded for loss of use of the pond. Defendants claimed that the pond had materially enhanced the value of their sites adjacent to the pond and that they were entitled to damages for the diminution in value of the sites. The court held that defendants, as riparian owners, had no right to demand permanent maintenance of the dam even though it had existed for 30 years. Consequential damages could only be awarded for the wrongful invasion of some right, and defendants had no rights to the pond or its water. (Hubener-Florida)
W71-00238

MACEDONIA BAPTIST CHURCH V CITY OF COLUMBIA (FLOODING FROM SURFACE DRAINAGE OF MUNICIPAL STREETS).
10 SE2d 350-359 (SC 1940).

Descriptors: *South Carolina, *Surface drainage, *Drainage systems, *Flood damage, Drainage, Ditches, Drainage effects, Drainage waters, Surface waters, Surface runoff, Damages, Floods, Judicial decisions, Legislation, Overland flow, Runoff, Cities, Local governments.

In an action for damages caused by surface waters which were drained from defendant municipality's streets and cast on plaintiff's land, plaintiff contended that the defendant was negligent per se in causing plaintiff's land to be flooded in that an adequate drainage system was not provided for such surface waters as required by statute. Defendant contended that any damage sustained by plaintiff resulted from causes over which defendant had no control and thus precluded defendant from liability. The court found that there was evidence to the effect that defendant had opened up ditches, cleaned sidewalks, widened roadbeds and performed other acts so as to cause the amount of water being drained to be substantially increased. The court thus held that such evidence was sufficient to establish that defendant had done such acts as to have required it to provide an adequate drainage system as called for by the statute, and upon its failure to so provide, defendant was negligent per se. The jury verdict for plaintiff was affirmed. (Snow-Florida)
W71-00239

KOONE V CAROLINA MOUNTAIN POWER CORP (NEGLIGENT OPENING OF FLOODGATES).
217 NC 286, 7 SE2d 565-566 (1940).

Descriptors: *North Carolina, *Dams, *Flood damage, *Impounded waters, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Proprietary power, Relative rights, Riparian land, Riparian rights, Riparian waters, Rivers, Remedies, Damages, Dam failure, Floodgates, Overflow, Flooding, Floodwater, Excessive precipitation.
Identifiers: *Negligence.

Defendant power company constructed a dam across a stream, thus forming a lake behind the dam. Several days of rain caused the waters of the stream to become swollen and caused the level of the lake behind the dam to rise to the crest of the dam. Fearing that the dam might be swept away, defendant opened its floodgates, causing large amounts of water to flow into the already swollen stream. The stream then overflowed plaintiff's land resulting in extensive damages thereto. At trial a motion for nonsuit was granted to defendant. The Supreme Court of North Carolina reversed, holding that the evidence of the allegations of negligence in the complaint was sufficient to be submitted to the jury. (Clarke-Florida)
W71-00240

DAVENPORT V PITT COUNTY DRAINAGE DIST NO 2 (FLOODING FROM WRONGFUL CONSTRUCTION OF DRAINAGE SYSTEM).

220 NC 237, 17 SE2d 1-4 (1941).

Descriptors: *North Carolina, *Flood damage, *Overflow, *Drainage districts, Flooding, Flood water, Ponding, Drainage systems, Floods, Drainage, Ditches, Drainage effects, Drainage water, Judicial decisions, Conduits, Drainage, Engineering, Damages, Canal construction, Canals, Obstruction to flow, Legal aspects, Administrative agencies.

In an action for damage to crops resulting from overflow of a drainage ditch, plaintiff contended that defendant drainage district had negligently constructed a canal which resulted in plaintiff's lands being flooded and his crops destroyed. Plaintiff also contended that defendant had breached a contract wherein defendant had agreed to properly drain plaintiff's lands. Defendant contended that the negligence action was barred by a three year statute of limitation and that the contract was void. The court held that the flooding, though intermittent, was permanent so as to constitute a continuing trespass, and as such the cause of action accrued at the time of the initial flooding some seventeen years earlier so as not to be barred by the statute of limitations. The court further held that the contract was entered into only by the individual commissioners of the drainage district and was not the product of a formal corporate action as required by law. Consequently, the contract was invalid. Since plaintiff had no available remedy, the judgment for defendant was affirmed. (Snow-Florida)
W71-00241

HAMPTON V NORTH CAROLINA PULP CO (PRIVATE REMEDY FOR POLLUTION).
223 NC 535, 27 SE2d 538-547 (1943).

Descriptors: *North Carolina, *Water pollution, *Riparian rights, *Fisheries, Stream fisheries, Commercial fishing, Fish, Fishing, Migration, Judicial decisions, Legal aspects, Legislation, Water law, Impaired water quality, Pollutants, Reasonable use, Wastes, Water pollution effects, Chemical wastes, Industrial wastes, Relative rights, Remedies, Competing uses, Riparian waters, Streams.

Plaintiff fisheries operator brought action for damages and other relief from injuries resulting from the discharge of wastes from defendant's industrial plant downstream. Plaintiff alleged that pollution caused by defendant deterred fish from traveling upstream to plaintiff's fishery and interfered with plaintiff's livelihood. Defendant contended that any damage caused by his operation was purely public and created no cause of action in a riparian owner. The trial court dismissed the complaint, citing a case in which a fisheries owner

had been denied relief from damage caused by erection of a mill dam. The Supreme Court of North Carolina reversed, distinguishing the latter case on the grounds that operation of the mill dam was lawful, and riparian owners may not complain of private damages caused by reasonable exercise of a lawful right. In the instant case, however, pollution of the stream was in violation of state law. The court held that owners of fisheries upstream may maintain actions for wrongful interference with the migratory passage of fish whereby their fisheries are injured. It was irrelevant to the question of the peculiar nature of injury that damage was to a class of individuals. (Dye-Florida)
W71-00243

NANTAHALA POWER AND LIGHT CO V MOSS (CONDEMNATION OF RIGHT TO DIVERT RIVER FLOW).
220 NC 200, 17 SE2d 10-20 (1941).

Descriptors: *North Carolina, *Dams, *Condemnation value, *Compensation, Condemnation, Engineering structures, Rivers, River flow, Damsites, Riparian rights, Alteration of flow, Diversion, Riparian land, Riparian waters, Diversion structures, Streamflow, Diversion dams, Diversion losses, Water loss, Value, Judicial decisions.

Plaintiff power company brought a condemnation proceeding to acquire the right to divert the waters of a river which was adjacent to the lands of defendant riparian owners. Plaintiff, having constructed a dam for power purposes upstream from defendants' lands, contended that the value to be given for the property taken was to be determined on the basis of its value in the hands of defendants. Defendants contended that the value was to be determined on the basis of the enhanced value and advantages accruing to the one condemning the property and that inasmuch as the right to divert the water from the lands was indispensable to the plaintiff, such could be considered by the jury in evaluating the property. The court held that just compensation in condemnation proceedings merely required that the owner of the property taken should be paid for that taken from him and that the value of the property to the condemner for his particular use was not to be considered. (Snow-Florida)
W71-00244

DOMAN V BALTIMORE AND O RR (OVERFLOW FROM OBSTRUCTION BY BRIDGE CONSTRUCTION).
22 SE2d 703-706 (W Va 1942).

Descriptors: *West Virginia, *Obstruction to flow, *Bridges, *Alteration of flow, Railroads, Engineering structures, Rivers, Barriers, River flow, Damages, Flow, Erosion, Flood damages, Flooding, Overflow, Judicial decisions, Floods, Beds, River beds, Legal aspects.

In an action for damages, plaintiff contended that defendant railroad company, by laying the foundation of a bridge in a river bed, obstructed and altered the flow of the river in times of flood so as to cause the river to overflow and wash away plaintiff's lands abutting the river. Defendant contended that the construction of the bridge did not affect the ordinary level of the floodwaters which invaded plaintiff's land so as to be a contributing cause to plaintiff's damages. The court held that the evidence was not sufficient to establish that the bridge materially obstructed the river's flow or that it caused or contributed to the flooding and resultant damage of plaintiff's land. The jury's verdict for defendant was affirmed. (Snow-Florida)
W71-00256

KANE V CITY OF NAUGATUCK (DAMAGES FROM FLOW OF SURFACE WATER).
120 Conn 548, 183 A 227-229 (1935).

Descriptors: *Connecticut, *Surface drainage, *Drainage water, *Roads, Drainage, Surface runoff, Runoff, Floods, Overland flow, Soil erosion, Judicial decisions, Damages, Highways, Flow, Natural flow, Legal aspects, Cities.

In an action for damages, plaintiff contended that defendant municipality had laid out and graded a highway which accumulated and discharged surface drainage water upon her premises, thus causing her property to be washed away. The court found from the evidence that the grading of the street did not throw any water upon plaintiff's property that would not have been discharged upon it by the natural surface flow. The court held that since defendant had done no act which contributed to plaintiff's damages, it could not be held responsible for such damages. (Snow-Florida)
W71-00266

ROGERS V BROWN (LICENSING OF CLAM CULTIVATION OPERATIONS).
190 A 632-634 (Me 1937).

Descriptors: *Maine, *Clams, *Commercial shellfish, *Permits, Aquatic animals, Judicial decisions, Legislation, Riparian land, Littoral, Shores, Riparian rights, Ownership of beds, Relative rights, Regulation, Shellfish, Coasts, Oceans, Administrative decisions, Administration.

In an action for mandamus, plaintiff sought to force municipal officers to grant him a license to plant and cultivate clams on the foreshores adjacent to the municipality. Plaintiff, a littoral property owner adjacent to such shores, contended that the legislative act authorizing municipal officers to exercise control over the planting and cultivating of clams directed such officials as a matter of course to grant a license to littoral proprietors. Defendant municipal officials contended that their power to grant licenses was discretionary and thus not subject to mandamus. The court held that the granting of licenses to plant and cultivate clams was a discretionary power and thus was not subject to the extraordinary writ of mandamus. (Snow-Florida)
W71-00278

EISENSTEIN V MAYOR, COUNSELOR AND ALDERMEN (CITY'S DRAINAGE SYSTEM MUST BE ADEQUATE TO ACCOMMODATE USUAL RAINFALL).
9 A2d 224-227 (Md 1939).

Descriptors: *Maryland, *Drainage systems, *Surface water, *Rainfall-runoff relationships, Precipitation excess, Rainfall intensity, Cities, Drainage, Floodwater, Diversion, Rain water, Sewers, Sewage disposal, Overflow, Basins, Floods, Flow augmentation, Judicial decisions, Legal aspects, Local governments, Cloudbursts, Relative rights, Repulsion (Legal aspects), Surface runoff.

Plaintiff's land was flooded and thereby damaged, allegedly as a result of a drainage system constructed and maintained by defendant city. Plaintiff sought to have defendant enjoined from maintaining the system in a manner that was inadequate to prevent his property from being flooded during heavy rains. Plaintiff did not allege negligence in the construction or maintenance of said system. The court ruled that defendant was not obligated to do more than take care of the usual and ordinary flow of water occasioned by rainfall or otherwise, and that infrequent and extraordinary occurrences which could not be foreseen and provided against created no obligation for defendant. Surface water is a common enemy and every proprietor must fight for himself so long as such water takes its natural course. Defendant could improve and repair streets without being liable for consequential damage caused by surface water to adjacent property. The trial court's judgment for defendant was affirmed. (Price-Florida)
W71-00279

STATE V RUVIDO (DEFINITION OF TERRITORIAL WATERS IN CRIMINAL PROSECUTION FOR VIOLATION OF TERRITORIAL LIMITS).
15 A2d 293-297 (Me 1940).

Descriptors: *Maine, *Boundary disputes, *Tidal waters, *State jurisdiction, Adjudication procedure, International law, Judicial decisions, Jurisdiction, Legal aspects, Legislation, Public rights, State governments, Water law, Water rights, Atlantic Ocean, Bays, Oceans, Coasts, Law of the sea, Shores, Islands, Continental margin, Commercial fishing, Seashores.
Identifiers: *Territorial waters.

Defendant commerical fisherman was convicted for a violation of a Maine statute prohibiting commercial fishing by non-residents in Maine's territorial waters between April 1st and November 1st. On appeal, defendant contended that he was fishing outside the state's territorial waters and that the statute was void for vagueness since it did not define territorial waters, nor did any other state statute. Affirming the conviction, the court adopted as a definition of territorial waters all waters within a marine league (three miles) from the coast, including bays not exceeding two marine leagues at their mouth. After extensive review of the geographical facts of the case, the court held that defendant was fishing within Maine's territorial limits. As to defendant's contention of vagueness, the court noted that the legislature could not exceed the territorial limits generally recognized by law, and held that the state's jurisdiction over territorial waters does not cease simply because the legislature has not defined them. (Liptak-Florida)
W71-00300

TOWARD AN EFFECTIVE AND CREDIBLE PROGRAM: WATER POLLUTION CONTROL,
Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.
Leonard B. Dworsky.
Transactions of the American Geophysical Union, Vol 51, No 8, August 1970, p 600-606. 16 ref.

Descriptors: *Planning, *Programs, *Federal government, *Water pollution, *Water quality, Navigable waters, Governments, Water pollution control, Water quality control, Water supply, Waste water treatment, Research and development, Sewage treatment, Technology, Management, Public health, Resource allocation, Priorities, Water policy.
Identifiers: *Public policy, *National water pollution control program, Policy, Technology assessment, Water quality management, Enforcement, Federal financial aid.

Marked changes are needed to produce an effective and credible national water pollution control program. Ten such changes are discussed: (1) federal jurisdiction over all navigable waters; (2) a national sewage and waste treatment policy; (3) a revision in the allocation of federal financial aid and the determination of project priorities; (4) regional water quality management programs as demonstration projects; (5) planning an effective national control program; (6) facilitating the use of advanced waste treatment technology; (7) improved enforcement of pollution control laws; (8) the consolidation of water supply and waste water service functions in local government; (9) research on better understanding the relationship between water pollution and public health; and (10) establishment of a program of technology assessment to assess consequences of man's actions. (Davis-Chicago)
W71-00311

SCANLON V IRON CITY SAND AND GRAVEL CO (LIABILITY FOR DREDGING OPERATIONS ABOVE THE LOW WATER MARK).

345 Pa 535, 29 A2d 82-84 (1942).

Descriptors: *Pennsylvania, *Dredging, *Boundary disputes, *Low water mark, Dams, Damages, Excavation, Rivers, Navigable rivers, Boundaries (Property), River beds, Banks, Riparian land, Islands, Judicial decisions, Water levels, Legal aspects, Water level fluctuations, Land tenure.

In an action to recover damages, plaintiff contended that defendant dredging company damaged its island property by removing sand and gravel above the ordinary low water line of the navigable river surrounding the island. Defendant contended that the ordinary low water line was no longer the boundary for measuring plaintiff's property. Instead, it was argued, the plaintiff owned only to a new mark, higher than the low water line, created by the raising of the level of the river by the construction of a dam by the federal government. Consequently, plaintiff did not own any land below the new mark and could not be harmed by defendant's operations. The court held that the raised water level by the construction of the dam did create a new line for determining the boundary of plaintiff's property. Therefore, the dredging did not interfere with plaintiff's possession, and defendant was not liable. (Snow-Florida)
W71-00314

CITY OF NEW BRUNSWICK V BOROUGH OF MILLTOWN (MUNICIPAL DISPOSAL OF WASTES).
135 NJ Eq 310, 38 A2d 288-290 (1944).

Descriptors: *New Jersey, *Municipal wastes, Contracts, *Sewage disposal, Sewage, Path of pollutants, Wastes, Water pollution, Water pollution sources, Water pollution control, Domestic wastes, Pollutants, Sewage treatment, Waste disposal, Judicial decisions, Streams, Water supply, Relative rights, Cities, Local governments.

In an action to have a contract cancelled, plaintiff city of New Brunswick contended that it had exceeded its power in entering into the contract and that the contract was void as being against public policy since it imposed a perpetual obligation. Defendant contended that the contract, which provided that plaintiff would dispose of defendant's sewage providing that the defendant would not dispose of its sewage into a common creek which would lead to the pollution of plaintiff's water supply, was valid and that plaintiff could not be excused from its execution because it was more burdensome than contemplated. The court held that there was statutory authorization for plaintiff to have entered into the contract and that there was no prohibition of a contract of perpetual duration. The contract was therefore valid and enforceable. (Snow-Florida)
W71-00328

LOVEJOY V TOWN OF DARIEN (DESTRUCTION OF COASTAL OYSTER BEDS BY MUNICIPAL CONSTRUCTION OF SEWAGE PIPELINES).
131 Conn 533, 41 A2d 98-101 (1945).

Descriptors: *Connecticut, *Oysters, *Commercial shellfish, *Ownership of beds, Permits, Aquatic animals, Aquatic life, Shellfish, Beds, Beds under water, Judicial decisions, Navigable waters, Navigation, Oceans, Relative rights, Damages, Coasts, Sewage disposal, Pipelines, Pipes, Cities, Jurisdiction.

In an action for damages, the owner of a state franchise for the cultivation of oysters in coastal waters contended that defendant municipality had destroyed the usefulness of his oyster bed by the construction of a sewage pipeline into the coastal area where the bed was located. Defendant municipality contended that it was not liable under a theory that the general public is the absolute owner of land under navigable waters and that therefore a sovereign is not liable for any damage to an individual that results from its acts. The court held that a sovereign has paramount rights over navigable waters in dealing with rights of navigation, but that when navigational rights are not involved or are not interferred with, then any property taken for a public use must be justly compensated for. Thus defendant was liable for damages done to the oyster bed since the construction of the sewage pipeline was not related to defendant's rights of control over navigation. (Snow-Florida)
W71-00351

KANARKOWSKI V BOROUGH OF NORTH BRADDOCK (DUTY OF CITY TO PROPERLY DRAIN STREETS).
157 Pa Super 325, 43 A2d 381-383 (1945).

Descriptors: *Pennsylvania, *Ice, *Highway icing, *Cities, Surface waters, Damages, Judicial decisions, Streams, Drainage, Drainage water, Runoff, Standing waters, Surface drainage, Ponding, Surface runoff.

In an action for damages for personal injury, plaintiff contended that defendant municipality was negligent in allowing a creek to overflow from a clogged spillway onto a street which upon becoming icy caused plaintiff to fall. The court held that the municipality was under a duty to provide for proper drainage of water from its public streets and upon its failure to do so, as a proximate cause of plaintiff's injuries, was liable for negligence. Jury verdict for the plaintiff was affirmed. (Snow-Florida)
W71-00399

STRAUCH V CITY OF SCRANTON (DUTY OF MUNICIPALITIES TO PROVIDE DRAINAGE FOR SURFACE WATERS).
353 Pa 10, 44 A2d 258-261 (1945).

Descriptors: *Pennsylvania, *Highway icing, *Drainage, *Surface waters, Ice, Judicial decisions, Drainage water, Runoff, Standing waters, Surface drainage, Freezing, Highways, Governments, Local governments, Damages, Legal aspects, Surface runoff, Cities.

In an action to recover for injuries sustained from a fall on ice in a municipal roadway, plaintiff contended that defendant municipality had a duty to provide a drainage system adequate to prevent the forming of ice in the roadway from the accumulation of surface water naturally flowing upon such roadway. Defendant contended that its duty to keep its streets in a reasonably safe condition did not extend to the providing of drainage for the natural flow of surface water. The court held that there was a duty to provide a drainage system only in the exceptional case, whereas in the ordinary case the providing of a drainage system rested in the discretion of the municipality. The court held that the flow and discharge of surface water in this case was not of sufficient quantity and volume to place it within the exceptional case. The court ruled that defendant, being under no duty to provide a drainage system, was not liable for the injuries resulting from plaintiff's fall on the ice. (Snow-Florida)
W71-00401

HARRISON V GRANDISON CO (STATE OWNERSHIP OF BEDS UNDER NAVIGABLE WATERS).
51 F Supp 768-775 (ED La 1943).

Descriptors: *Louisiana, *Ownership of beds, *Navigable waters, *Boundary disputes, Land tenure, Land, Real property, Oil, Oil industry, Drilling, Oil fields, Oil wells, Drill holes, Exploration, Bayous, Beds, Geds under water, Boundaries (Property), Islands, Judicial decisions, Legal aspects.
Identifiers: *Servitude.

Plaintiff landowner brought suit to have defendant company's mineral servitude over his land declared extinguished by non-use. Plaintiff's grantor had reserved such interest and had later transferred the rights to defendant. A Louisiana statute required exercise of such rights within ten years or else they would be forfeited. Defendant had sunk two wells, one within the ten year period and the other on the day the period ended. The wells were sunk in different areas of plaintiff's land and plaintiff argued that certain bayous which traversed his property were navigable, thus giving the state ownership of the beds and separating his land into several parcels. If this were true, then only the area contiguous to the first well would remain subject to the servitude and the allegedly separate area surrounding the second well would be free from defendant's interest. The United States District Court, Eastern District of Louisiana, found that the bayous were not navigable, that plaintiff's land was all one tract and that defendant's entry onto one part of the land was sufficient to preserve the servitude over the entire area owned by plaintiff. (Barker-Florida)
W71-00419

TOWN OF DICKSON V STEPHENS (SPECIAL DAMAGE REQUIRED TO RECOVER FOR POLLUTION DAMAGE FROM MUNICIPALITY).

96 SW2d 201-212 (Tenn Ct App 1935).

Descriptors: *Septic tanks, *Tennessee, *Water pollution, *Sewage disposal, Municipal wastes, Judicial decisions, Legal aspects, Environmental sanitation, Construction, Waste treatment, Damages, Rivers, Cities, Local government, Adjudication procedure.

Plaintiff was the owner of a tract of farming and pasture land which had a river flowing through it. Plaintiff brought an action against defendant municipality for damages which resulted from the alleged pollution of the river by the drainage of sewage from a disposal plant constructed by defendant. The Court of Appeals of Tennessee affirmed a trial court decision for plaintiff and held that there was evidence of a depreciation in the rental value of plaintiff's farm which constituted special damages to plaintiff's property not likewise suffered by the public at large; therefore, the plaintiff did not lack standing as contended by the defendant. The court also held that evidence as to whether the condition of the stream at plaintiff's property was a nuisance at the time complained was for the jury to consider. Furthermore, the court held that evidence as to the character of the running stream above the landowner's premises and at the disposal plant was admissible in determining the condition of the stream at landowner's premises. (Powell-Florida)
W71-00425

KELLEY V CITY OF CAPE GIRARDEAU (CITY'S LIABILITY FOR SUCCESSIVE OCCURRENCES OF FLOOD DAMAGE CAUSED BY FAULTY STREET DRAINAGE).
89 SW2d 41-46 (Mo 1935).

Descriptors: *Missouri, *Drainage water, *Flood damage, *Adjudication procedure, Judicial decisions, Legal aspects, Water law, Compensation, Water injury, Damages, Remedies, Surface drainage, Roads, Drainage effects, Grading, Surface drainage, Rain water, Runoff, Cities, Local governments, Drains, Flooding, Storm drains.

Plaintiff landowner brought action against defendant city for damages resulting from flooding of plaintiff's property caused by the improper grading, curbing and guttering of defendant's streets. Plaintiff had already recovered damages in several previous actions for flooding on specific dates, but defendant failed to correct the improper drainage, and plaintiff sought to recover for damages occurring both prior to and after the previous actions. Defendant contended that plaintiff was barred from recovering for any damage which occurred prior to the previous actions, as those damages should have been sought in those actions. Reversing a judgment for plaintiff, the court held

that each occurrence of flood damage gave rise to a distinct right of action but that, in any one action, plaintiff should have sought all damages which had occurred up to that time. Therefore, in the present action, plaintiff was barred from recovering for those damages which had occurred prior to his last action against defendant, but could recover for any flood damage which had occurred since then. (Liptak-Florida)
W71-00426

MILLER LEVEE DIST NO 2 V WRIGHT (COMPENSATION FOR LAND DAMAGED VIA EMINENT DOMAIN TAKING).
111 SW2d 469-472 (Ark 1937).

Descriptors: *Arkansas, *Eminent domain, *Condemnation, *Compensation, Right-of-way, Drainage, Levees, Damages, Judicial decisions, Legal aspects, Drainage effects, Drainage water, Drainage districts, Condemnation value, Drainage practices, Drainage systems, Crop response, Property values.

Plaintiff landowner brought action to recover damages for injury to his property caused by a loop levee constructed by defendant. Plaintiff contended his recovery should include damages for all injury caused by reason of the levee. Defendant contended that plaintiff's rights of recovery and damages, if any, were limited to the actual value of the land taken, damages for resulting inconvenience, and damages to the remainder of the property caused by obstruction to the natural drainage. The court ruled that defendant's contention was contrary to statutory law and the state constitution. Where there is any invasion of private property by lawful authority for a public use and the property is damaged thereby, there is a taking within the meaning of the law, and where the damage is such as to deprive the owner of the beneficial use of his property, he may require that its value be paid him. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-00432

PETERSON V CITY OF ST JOSEPH (TITLE TO ACCRETION TO ISLAND).
156 SW2d 691-695 (Mo 1941).

Descriptors: *Accretion (Legal aspects), *Riparian land, *Islands, *Missouri, Missouri River, Navigable rivers, Riparian rights, Interstate rivers, Banks, Boundaries (Property), River beds, Land tenure, Real property, Local governments, Cities, Judicial decisions, Legal aspects, Riparian waters, Land forming, Erosion.

Plaintiff landowner brought action against defendant city to determine title to land formed by accretion in the Missouri River. Plaintiff contended that the land was formed by accretion to an island in the river and that he acquired title to the land under a patent from the county. Defendant contended that the land was formed by accretion to the shore and, as a riparian owner of the shore, the city was entitled to the land. Affirming a judgment for plaintiff, the court held that land which first forms in the river and later attaches to the land does not vest title in the riparian owner unless he also owns the river bed. Since the land first formed by accretion to the island, title was properly in the owner of the island. (Liptak-Florida)
W71-00439

HALE V KANSAS CITY, MO (CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY FAILURE TO OPEN FLOODGATE DURING RAINSTORM).
187 SW2d 31-41 (Mo Ct App 1945).

Descriptors: *Missouri, *Flood damage, *Storm drains, *Flood gates, Subsidence, Settlement (Structural), Runoff, Rain water, Water injury, Remedies, Judicial decisions, Legal aspects, Adjudication procedure, Sewers, Surface water, Local governments, Citites, Drains, Backwater, Pumping plants, Flood control, Cloudbursts, Compensation, Drainage systems.

Plaintiff paper bag company brought action against defendant city for flood damage to plaintiff's building caused by defendant's failure to open the sewer system's main floodgate during a heavy rainstorm. Plaintiff contended that no flooding would have occurred if defendant had opened the main storm drain and operated its drainage pumps. Defendant argued that submission of plaintiff's contention to the jury was improper since the purpose of the floodgate was not to facilitate the sewage system's flow, but to prevent water from the river from backing up into the sewer system during high water. Affirming a judgment for plaintiff, the court held that, regardless of the primary purpose of the floodgate, the jury properly heard and decided the question of whether defendant's failure to open the gate during the rainstorm was the proximate cause of the damage to plaintiff's building. (Liptak-Florida)
W71-00444

LEGAL ASPECTS OF WATER STORAGE FOR FLOW AUGMENTATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 05G.
W71-00480

BENEFICIAL USE OF WATERSHEDS (IMPROVEMENT OF WATERSHED MANAGEMENT; NECESSITY FOR NEW WATER-ALLOCATION POLICY TO ACCOUNT FOR THE INCREASE IN RECREATIONAL USE).

American Water Works Association Journal, p 455-457 (1970).

Descriptors: *Watershed management, *Watershed Protect. and Flood Prev. Act, *Water allocation policy, *Water sports, Erosion control, Flood control, Surface runoff, Water management (Applied), Water supply, Watersheds (Basins), Small watersheds, Multiple-purpose projects, Pre-impoundment, Water shortage, Water utilization, Recreation, Water conservation, Water pollution control, Irrigation programs, Municipal water, Sedimentation.

Two papers discuss the increased awareness of the importance of proper protection and management of watersheds. The first paper points out the rapid increase in recreational use of water supplies and the need to consider such use--in addition to the traditional uses for public supply, navigation, irrigation, and power generation--when planning water priorities, pollution control, and cost allocation. The second paper discusses the problem of small watersheds and the results of the Federal Watershed Protection and Flood Prevention Program which assists local communities in providing for flood prevention as well as the development of municipal, industrial, agricultural, and recreational water resources. (Liptak-Florida)
W71-00487

INDIANAPOLIS WATER CO V LUX (NECESSITY FOR CONDEMNATION OF PROPERTY FOR RESERVOIR).
64 NE2d 790-794 (Ind 1946).

Descriptors: *Indiana, *Condemnation, *Reservoirs, *Compensation, Eminent domain, Remedies, Damages, Dams, Backwater, Flooding, Flood damage, Water injury, Judicial decisions, Legal aspects, Adjudication procedure, Administrative decisions, Water supply, Water works, Public utilities, Real property.

Plaintiff water company brought action against defendant property owners to condemn their land for the construction of a dam and a reservoir. Plaintiff contended that some portions of defendants' land would be permanently flooded, some would be flooded at times of high water, and the remainder of the property was necessary for a border around the reservoir. Defendants argued that the land was not necessary for the proposed project. Reversing a judgment for defendants, the court noted that the question of necessity is usually left to the discretion of the condemning agency, but in a case where the contention is that there is no need at all, the courts will review such agency's decision. The court held that, although it usually does not weight the evidence, defendants had no evidence to dispute plaintiff's contentions or to justify the lower court's opinion. (Liptak-Florida)
W71-00488

NORTHERN STATES POWER CO V FEDERAL POWER COMM'N (REGULATORY POWER OF THE FEDERAL POWER COMMISSION).
118 F2d 141-144 (7th Cir 1941).

Descriptors: *Wisconsin, *Administrative agencies, *Public utilities, *Navigable waters, Judicial decisions, Legal aspects, Legislation, Federal government, Costs, Powerplants, Regulation, Permits, Hydroelectric power, Hydroelectric plants, Hydroelectric project licensing, Supervisory control (Power).
Identifiers: *Federal Water Power Act.

Petitioner utility company instituted proceedings to set aside a portion of an order by the Federal Power Commission directing petitioner to charge off certain items from its books in accord with the Commission's accounting requirements. Petitioner had applied with the Commission to have its utility project licensed in accord with the Federal Water Power Act. The court stated that the Act contemplates construction and operation of water power projects on navigable waters and government lands. Under certain circumstances, the government may take over projects, in which case the licensee receives reimbursement for its net investment. The Commission had ordered petitioner to charge certain items off because they did not represent a part of its net investment. Petitioner did not argue that these items were in its net investment, but questioned the right of the Commission to require it to strike these items from its account. There is no express authority in the Act empowering the Commission to require uniform accounting. The court found that the Commission's orders were a reasonable exercise of its power pursuant to the Act. These orders were not binding upon state utility agencies and did not constitute an unreasonable invasion in the field of management. (Duss-Florida)
W71-00489

HARPER V LEARNED (BOUNDARY DISPUTE OVER BATTURE LAND).

199 La 398, 6 So 2d 326-333 (1942).

Descriptors: *Louisiana, *Boundary disputes, *Accretion (Legal aspects), *Mississippi River, Boundaries (Property), Navigable rivers, Ownership of beds, Islands, Riparian rights, Lumbering, Riparian land, Riparian waters, Legal aspects, Judicial decisions, Adjudication procedure, Relative rights.

Plaintiff riparian landowner brought action against defendant riparian landowner to determine the mutual boundary between their respective batture lands and for damages for wrongful removal of timber. Plaintiff and defendant's predecessor in interest had agreed orally 40 years previously upon a visible boundary between their respective properties; defendant purchased his land in reliance upon that boundary. The court held that plaintiff was estopped from maintaining that the boundary previously agreed upon was not the proper boundary as between himself and defendant. The court stated that the batture lands were granted to the riparian owner by law, observing that parol evidence was admissible to prove a visible bounda-

ry recognized by the parties. Plaintiff's suit was dismissed by the court. (Hart-Florida)
W71-00490

LOSSING V SHULL (ONE WHO ACQUIRES TITLE TO MAIN LAND BY ADVERSE POSSESSION ACQUIRES TITLE TO ACCRETED LAND).
173 SW2d 1-8 (Mo 1943).

Descriptors: *Missouri, *Accretion (Legal aspects), *Prescriptive rights, *Patents, Judicial decisions, Legal aspects, Rivers, Mississippi River, Boundaries (Property), Bank erosion, Water rights, Riparian rights, Riparian land, Banks, Remedies, Riparian waters, Prior appropriation.
Identifiers: *Adverse possession.

An 1860 patent granted a portion of the west high bank of the Mississippi River to plaintiff's predecessors in title. The patent failed to expressly name the state and county wherein the land was located. Five acres of land were added to this grant through accretion. In 1932, defendant's predecessor in title docked his houseboat on the accreted tract, assumed possession, and subsequently, conveyed the accreted land to defendant. Plaintiff brought an action to quiet title and an action in ejectment for the accreted land. Defendant contended that plaintiff, having failed to establish title by deed in any land at the river's edge because of the defective patent, could not maintain an ejectment action for accreted land. Defendant further contended that, if plaintiff acquired the granted land by adverse possession, title was not acquired so that accretion would attach to such lands. The Supreme Court of Missouri, in affirming a judgment for plaintiff, held that the defective patent was sufficient to pass title. Furthermore, accretion becomes a part of the land to which it is built, and follows whatever title covers the main land, whether it be title by deed or by adverse possession. (Powell-Florida)
W71-00491

GERLACH LIVESTOCK CO V THE UNITED STATES (RIPARIAN RIGHTS ARE PROPERTY RIGHTS NOT TO BE TAKEN WITHOUT JUST COMPENSATION).

102 Ct Cl 392-399 (1944).

Descriptors: *California, *Condemnation, *Riparian rights, *Compensation, Diversion losses, Eminent domain, Irrigation, Navigable waters, Navigation, Relative rights, Public rights, Federal government, Flood control, Legislation, Land reclamation, Dams, Riparian land, Riparian waters, Judicial decisions, Legal aspects, Alteration of flow, Diversion dams.

Plaintiff landowner sought to recover the value of his water rights allegedly lost by the construction of a dam by defendant United States. Plaintiff contended defendant's action was a taking of private property as contemplated by the fifth amendment. Defendant contended that plaintiff's petition failed to allege a taking of its property or property rights within the meaning of said amendment, and that any damage was indriect, consequential, and not within the jurisdiction of the court. The court ruled that a landowner's rights in a navigable stream are subject to the paramount right of the government to take whatever steps it deems necessary in the improvement of navigation, but the government has no such right in the water of a stream for irrigation purposes. Plaintiffis riparian rights in the stream, if any, were property rights, of which he could not be deprived without being paid just compensation. Defendant's demurrer was overruled. (Price-Florida)
W71-00492

PITT RIVER POWER CO V UNITED STATES (RIGHT TO COMPENSATION FOR CONDEMNATION ACCRUES ONLY AFTER ACTUAL LOSS OCCURS).
98 Ct Cl 253-256 (1942).

Descriptors: *California, *Flood damage, *Riparian rights, *Land reclamation, Judicial decisions, Legal aspects, Flood protection, Flooding, Flood control, Eminent domain, Condemnation, Federal government, Dams, Legislation, Canals, Reservoirs, Adjudication procedure, Compensation, Water injury.

Plaintiff landowner sought damages under a condemnation theory for flooded lands, for lands that would not be flooded but would be damaged due to flooding, and for the loss of riparian rights that he contended would result from defendant United States' construction of dams and reservoirs near his property. Defendant contended that plaintiff had failed to state a cause of action as the dams were not completed, no flooding had taken place, and plaintiff had not sustained any loss. The court, held that no cause of action had been stated since no loss had come to plaintiff and no loss might ever come as the project might never be completed. The granting of defendant's demurrer was sustained. (Price-Florida)
W71-00493

THE OYSTER CASES (DAMAGE TO OYSTER BEDS CAUSED BY DREDGING OPERATIONS).
94 Ct Cl 397-441 (1941).

Descriptors: *United States, *Oysters, *Dredging, *Damages, Federal jurisdiction, Channel improvement, Bottom sediments, Ownership of bed, Legislation, Beds, Silting, Channels, Harbors, Coastal engineering, Legal aspects, Navigation, Compensation, Adjudication procedure, Leases, Commercial shellfish, Federal government.

Plaintiffs claimed that their oyster beds had been damaged by dredging operations of the United States. A suction dredge used to improve the New Haven harbor channel threw up large quantities of mud and silt, covering the oyster beds and killing the oysters. Shovel-type dredges had previously been used with little damage to beds. The court found that the failure of the United States to give notice, until shortly before the operation began, that the suction dredge would be used constituted failure to use due care in the protection of plaintiffs' property. In all instances, the court found that the exact amount of damage was impossible to determine. Also, despite the short notice, the court held that plaintiffs could have mitigated damages to some extent by moving as many oysters as possible out of the affected area beforehand. In each instance, plaintiffs recovered the court's estimate of non-mitigable damages. (Caldwell-Florida)
W71-00494

KIRCH V UNITED STATES (CONDEMNATION OF RIPARIAN LAND BY FAILURE TO MAINTAIN LEVEE).
91 Ct Cl 196-203 (1940).

Descriptors: *Louisiana, *Compensation, *Levees, *Condemnation, Mississippi River, Flood protection, Eminent domain, Shore protection, Flooding, Flood damage, Soaking, Water injury, Federal government, United States, Federal project policy, Administrative agencies, Depreciation, Judicial decisions, Legal aspects, Erosion.

Plaintiff riparian landowner sought to recover damages under the fifth amendment of the Constitution from defendant United States for a taking of his property. Plaintiff's land extended to a levee on the Mississippi River. Because of continued erosion by the river, defendant erected a second levee further back from the river, leaving the original levee and plaintiff's land between the levees to be flooded and eroded. Plaintiff contended that this action constituted a taking under the fifth amendment. The court initially noted that erection of the set-back levee did not cause the river to flood plaintiff's land, and that flood control legislation did not assume responsibility for consequential damages. The court stated that defendant had no duty to erect and maintain levees to protect riparian owners, and hence was under no duty to respond in damages. Loss of market value was found by the court not to constitute a fifth amendment taking. The court concluded that there had been no taking within the fifth amendment, and dismissed plaintiff's petition. (Hart-Florida)
W71-00495

MATTHEWS V UNITED STATES (LIABILITY FOR CONSEQUENTIAL FLOODING CAUSED BY FLOOD CONTROL PROJECT).
87 Ct Cl 662-721 (1938).

Descriptors: *United States, *Flood control, *Condemnation, *Compensation, Easements, Flood damage, Legislation, Levees, Floodways, Damages, Land use, Legal aspects, Floods, Flood plains, River basins, Backwater, Surface drainage, Rivers, Flooding, Historic flood, Water levels, Overflow, Blowouts, Mississippi River.

Plaintiff sought compensation for an alleged taking of his land. He claimed that the construction of a flood control project along the Mississippi River would result in backwater being diverted onto his forestland whenever the river reached a certain level. While the evidence supported plaintiff's contention, it was also brought out that the property had always been subject to flooding when the river reached that level. The court held that to constitute a compensable taking, the overflow had to be the direct result of and wholly attributable to the government project, and constitute an actual and permanent invasion of the land. Because the alleged flooding was held to be merely a temporary condition, and because the project was not the sole cause of the flooding, any damage which the plaintiff had suffered was held to be merely consequential injury. Such injury was held non-compensable, and recovery was denied. (Caldwell-Florida)
W71-00496

MARRET V UNITED STATES (LIABILITY FOR DAMAGES CAUSED BY RAISING WATER LEVEL OF RIVER).
82 Ct Cl 1-14 (1935).

Descriptors: *Kentucky, *Dams, *Eminent domain, *Water levels, Ownership of beds, Navigable rivers, Navigation, Riparian land, Riparian rights, Riparian waters, Federal Power Act, High water mark, Low water mark, Condemnation, Damages, Water injury, Flooding, Flood damage, Buildings, Judicial decisions, Legal aspects, Water level fluctuation, United States.

Plaintiff landowner brought action against defendant United States for inverse condemnation. Plaintiff owned riparian land located on a river. He erected a resort hotel in the river bed, designing it so that periodic high water would flow through the lower floor. Defendant United States raised its dam level two feet, causing a permanent increase in the river level and flooding the lower part of the hotel. Consequently, the hotel structure began to settle and crack. Plaintiff contended that his property was taken without just compensation. The court noted the marked distinction between a taking and mere resulting damage, and held that defendant was not liable for plaintiff's damages. The court found that a riparian owner's title to the bed below high water mark was subservient to the paramount power of defendant to improve navigation. Concluding that plaintiff was merely damaged by rightful government action, the court dismissed plaintiff's petition. (Hart-Florida)
W71-00497

L J HOUZE CONVEX GLASS CO V UNITED STATES (WATER DAMAGE TO GAS WELL).
81 Ct Cl 661-670 (1935).

Descriptors: *New York, *Dams, *Navigable rivers, *Wells, Natural gas, Design flood, Ponding, Eminent domain, Condemnation, Condemnation value, Navigation, Flooding, Inflow, Soaking, Submergence, Wetting, Flood damage, Judicial decisions, Legal aspects, Overflow, Dam design, United States.

Plaintiff glass company sued defendant United States for damages to plaintiff's gas well. Defendant raised the height of its dam, which made the earth around plaintiff's well wet and infirm. Two subsequent floods caused water to overflow into plaintiff's well, stopping gas production. Plaintiff contended that raising the dam height caused the well to overflow; defendant claimed the subsequent floods were the direct cause of plaintiff's injury. The court noted that defendant had the power to construct a dam in aid of navigation, and that defendant could be liable for property taken as a direct result. However, the court found that defendant was not liable for consequences not directly attributable to the dam, and since the floods caused plaintiff's injury, the court dismissed plaintiff's petition. (Hart-Florida)
W71-00498

JOHNSON V UNITED STATES (FLOODING CAUSED BY INCREASING DAM HEIGHT).
80 Ct Cl 367-375 (1934).

Descriptors: *West Virginia, *Flooding, *Dams, *Compensation, Eminent domain, Condemnation value, Condemnation, Flood damage, Design flood, Damages, Judicial decisions, Legal aspects, Submergence, Ponding, Navigation, Dam design.

Plaintiff landowner sued defendant United States for damages for inverse condemnation of plaintiff's land by defendant. Defendant increased the height of its dam, which caused inundation of plaintiff's land, rendering plaintiff's route of ingress and egress impassable. The court held that defendant's actions constituted a taking for public use, and that plaintiff was entitled to just compensation therefor. (Hart-Florida)
W71-00499

PEOPLE EX REL NEW YORK CENT RR V STATE TAX COMM'N (NAVIGABILITY OF RIVER DETERMINES TAX ASSESSMENT).
268 App Div 805, 48 NYS2d 570-571 (1944).

Descriptors: *New York, *Navigable rivers, *Bridges, *Assessments, Taxes, Navigable waters, Rivers, Streams, Administrative agencies, State governments, Judicial decisions, Legal aspects, Administrative decisions, Railroads.

Plaintiff railroad company brought action to review a tax assessment of defendant Tax Commission. Defendant had assessed plaintiff's bridge as a special franchise. The navigability of the river at the bridge determined whether the bridge was a special franchise. The court noted that the legislature had twice declared the river a public highway for transportation of logs and other property, and found that the lower court had improperly tested navigability by whether the bridge interfered with use of the river as a public highway. Holding that the river was navigable and that the assessment was proper, the court reversed the lower court's decision for plaintiff. (Hart-Florida)
W71-00500

NIAGARA FALLS POWER CO V MALTBIE (CONTROL OF HYDROELECTRIC POWER RATES).
41 NYS2d 424-432 (1943).

Descriptors: *New York, *Navigable rivers, *Hydroelectric power, *Federal Power Act, Hydroelectric plants, Hydroelectric project licensing, Dams, Administrative agencies, Electric power rates, State governments, Water allocation (Policy), Administrative decisions, Judicial decisions, Legal aspects, Federal government.

Plaintiff hydroelectric company brought action against defendant public service commission to review a rate order promulgated by defendant. Plaintiff's dam was on the Niagara River. Requirements for additional war production caused the Federal Power Commission to allow plaintiff to divert more water, but the Commission required that an amount equal to the additional profits generated thereby at the present rate be placed in a reserve fund. However, defendant also reduced the rate which plaintiff could charge commensurately with the profit from the additional diversion. Hence, if plaintiff complied with the orders of both commissions, it would operate at a substantial loss. The court noted that since the river was navigable, Congress had power to regulate use of the water. Furthermore, the court found that the Commission had no authority under the Federal Power Act to fix rates, that authority being reserved to defendant. Therefore, the court held that defendant's rate was proper, and since no profit would be created at the lowered rate, no payments would accrue to the reserve fund. (Hart-Florida)
W71-00501

PEOPLE EX REL NEW YORK CENTRAL RR V STATE TAX COMM'N (NAVIGABILITY CRITERIA IN DETERMINING TAXABILITY OF BRIDGE).
258 App Div 356, 16 NYS2d 812-819 (1940).

Descriptors: *New York, *Taxes, *Navigable waters, *Bridges, Railroads, Ownership of beds, Rivers, Non-navigable waters, Riparian rights, Public rights, Easements, Legal aspects, Judicial decisions, Bays, Structures, Bridge design, Beds under water, Boats, Transportation, Legislation, Administrative agencies.

Plaintiff railroad sought to have a special franchise tax, which defendant State Tax Commission had levied on several of its bridges, annulled. The tax was applicable only to bridges crossing navigable waters for a distance of more than 250 feet. The railroad contended that although the total length of each bridge exceeded 250 feet, only that portion of the river beneath the bridges' high center span was in fact navigable, and that it was this shorter length which should be used in determining the applicability of the statute. The court rejected this contention, holding that the historic test for navigability was whether the waterbody could be used for waterborne commerce. If this test was met, the entire river was to be considered navigable, not just the portion actually used by the commercial transportation. The imposition of the franchise tax was upheld by the court, which held that the entire width of a navigable stream was to be considered in determining whether the 250 foot criteria was met. (Caldwell-Florida)
W71-00502

PEOPLE V REILLY (RIGHT TO REGULATE ACTIVITIES OVER OWNED BEDS).
14 NYS2d 589-595 (1939).

Descriptors: *New York, *Boating regulations, *State jurisdiction, *Coasts, Administrative agencies, Boats, Supervisory control (Power), Regulation, Legal aspects, Judicial decisions, Ownership of beds, Beaches, Navigable waters, Atlantic Ocean, Recreation, Navigation, Relative rights, Public rights, Condemnation, Beds under water, Local governments.

Defendant was accused of violating the city's regulations forbidding advertising or boating within 1000 feet of the Coney Island Beach. He challenged the city's jurisdiction over him on the grounds that the city's boundary ran only to the low water mark of the ocean. He contended that any regulation covering areas beyond the city boundary would therefore be invalid. However, the city had previously acquired through condemnation the ocean beds extending out 1000 feet into the Atlantic Ocean. The court held that in the absence of express statutory limitations, the boundaries of the city extended to the farthest point of the territory owned by it. As the defendant's actions took place in the ocean less than 1000 feet offshore, the city was held to have jurisdiction. The court found the regulations to be reasonable, and the defendant was found guilty of violating them. (Caldwell Florida)
W71-00503

WOOD V MAITLAND (DISPUTE OVER TITLE TO LAKESHORE AND MARSH).
169 Misc 484, 8 NYS2d 146-157 (1938).

Descriptors: *New York, *Boundaries (Property), *Lakes, *Boundary disputes, Water levels, Water level fluctuations, Shores, Legal aspects, Marshes, Land tenure, Relative rights, Judicial decisions, Navigable waters, Inland waterways, Outlets, Ponds, Lake Ontario, Low water mark, State governments.

Plaintiff sought to assert title to property along Lake Ontario down to the existing shoreline. Defendant state claimed that the original grant to plaintiff's predecessor in title, reflecting a boundary 'along the lake', fixed the boundary of the property at the shoreline as of the date of the grant. The water level having fallen since the grant, the state claimed ownership of the additional exposed land. The court rejected this claim, holding that the proper boundary was the variable low water mark of the lake and that plaintiff therefore owned the additional land. Plaintiff similarly asserted his claim to a pond and marsh on his property near Lake Ontario, defendant claiming that they were really part of the lake belonging to the state. The court found that as the pond level was higher than that of the lake, it was not and never had been part of the lake. The state could assert no title in it. (Caldwell Florida)
W71-00504

JOHN B KELLY, INC V LEHIGH NAV COAL CO (POLLUTION OF RIVER BY COAL MINING INDUSTRY).
151 F2d 743-749 (3d Cir 1945).

Descriptors: *Pennsylvania, *Water pollution, *Coal mine wastes, *River beds, Flooding, Coal mines, Water pollution sources, Water injury, Damages, Hydraulic mining, Pollutants, Water pollution effects, Federal jurisdiction, Judicial decisions, Legal aspects, Adjudication procedure, Industrial wastes.

Plaintiff riparian landowner sought damages and restraining injunction against defendant coal mining companies for discharge of mining wastes into river. Plaintiff contended that discharge of the wastes polluted the river, raised the river bed on plaintiff's land, interfered with plaintiff's business and constituted a continuing trespass on plaintiff's land. Defendants contended that plaintiff failed to allege damages in the jurisdictional amount and that plaintiff's damages were not special, but common with the public at large. The court found that liability of the companies was several rather than joint, but concluded that damages were merely collateral to the injunction sought, and therefore jurisdiction might properly be assumed over the issue of damages. Furthermore, the court found that plaintiff had sufficiently asserted special damages by alleging that the waste was settling upon his land and raising the water level over plaintiff's land. Plaintiff's complaint was held to state a cause of action. (Hart-Florida)
W71-00505

UNITED STATES V BELT (TITLE DISPUTE OVER RIPARIAN LAND).
142 F2d 761-67 (DC Cir 1944).

Descriptors: *District of Columbia, *Navigable rivers, *Riparian rights, *Boundary disputes, Navigation, Riparian land, Riparian waters, Highways, Federal government, Administrative agencies, United States, Reservation doctrine, J

dicial decisions, Legal aspects, Boundaries (Property), United States, Land tenure, Real property.
Identifiers: *Title disputes.

Plaintiff United States brought action to quiet title to riparian land claimed by defendant landowner. Defendant owned land lying between a road and a river; such land was conveyed to defendant's predecessor in interest by United States commissioners in consideration for other lands. Plaintiff contended that the commissioners had only conveyed a water privilege to defendant's predecessor. The court noted that riparian rights include access for navigation and the right to erect wharves, subject to sovereign regulation, and found that while riparian rights were qualified by the rights of the public, they could not be arbitrarily impaired. The previous conveyance by the commissioners to defendant's predecessors in title was held to be in fee simple, with full riparian rights adhering thereto, and the lower court's decision for defendant was affirmed. (Hart-Florida)
W71-00506

BANKLINE OIL CO V COMMISSIONER OF INTERNAL REVENUE (INCOME TO TENANT DERIVED FROM LEASE OF TIDELANDS FROM STATE IS TAXABLE).

0 F2d 899-906 (9th Cir 1937).

Descriptors: *California, *Legislation, *Taxes, Ownership of beds, Mineralogy, Permits, Rent, Mineral industry, Judicial decisions, Legal aspects, Public benefits, Public rights, Navigation, Relative rights, Leases, Administrative agencies, Administrative decisions.

In a petition for the review of decisins of the United States Board of Tax Appeals, petitioner sought exemption during the taxable year 1930 of all income derived from tidelands leased from the State of California for the purpose of producing oil and gas therefrom. The court stated that the State of California holds the tidelands within its boundaries in trust for the people so that they may enjoy the navigation of the waters, carry on commerce, and have the liberty of fishing therein free from interference of private parties. Petitioner's lease was granted pursuant to state statute, and the state supreme court had upheld such legislation against claims that it violated said trust. The income tax was not levied on the land so held in trust, nor the income of the state derived therefrom. The tenant obtaining such a lease for his own profit is subject to taxation, even if such liability reduces the amount received by the state as consideration for the lease. The Board's decision was affirmed as to petitioner's tax liability for income derived from the tidelands. (Price-Florida)
W71-00507

HEWITT V PERRY (ENJOINING OF INTERFERENCE WITH RECREATION EASEMENT).
4 NE2d 489-492 (Mass 1941).

Descriptors: *Massachusetts, *Bulkheads, *Easements, *Beaches, Beach erosion, Tidal effects, Shore protection, High water mark, Low water mark, Recreation, Swimming, Fishing, Boating, Retaining walls, Judicial decisions, Legal aspects, Relative rights, Remedies, Access routes.

Plaintiff easement holder sought to enjoin defendant riparian landowner from erecting a bulkhead which would interfere with plaintiff's easement. Plaintiff owned an easement appurtenant across defendant's beach for swimming, boating, fishing and recreation; plaintiff operated a boat rental business pursuant to the easement. Defendant had erected a bulkhead along the beach, and planned to extend it. Plaintiff asserted that the bulkhead interfered with his easement, and defendant counterclaimed that plaintiff's boat rental business surcharged the easement. The court noted that a beach is primarily the area between high and low water marks, but that in this instance the word had assumed a secondary meaning as land above the high water mark. The court held that defendant's ownership of the beach provided no right to interfere with plaintiff's easement, and ordered removal of the bulkhead. As to defendant's counterclaim, the court found that plaintiff's easement did not include operating a commercial boat-letting business, and enjoined plaintiff from its operation. (Hart-Florida)
W71-00508

STATE EX REL DUFFY V LAKEFRONT EAST FIFTY-FIFTH ST CORP (TITLE DISPUTE IN LITTORAL RELICTION).
137 Ohio St 8, 27 NE2d 485-487 (1940).

Descriptors: *Ohio, *Lake Erie, *Accretions (Legal aspects), *Boundary disputes, Boundaries (Property), Landfills, Land forming, Lakes, Lake beds, Bulkheads, State governments, Lake shores, Navigation, State jurisdiction, Reservation doctrine, Judicial decisions, Legal aspects, Littoral, Leases, Real property.
Identifiers: *Title disputes.

Plaintiff state brought action to evict defendant littoral leaseholder from a reliction on Lake Erie. The reliction was formed when the contiguous owners artificially filled their landfronts, forming a pocket in front of defendant's leasehold which facilitated natural accretion. Defendant contended ownership of the reliction by common law, while plaintiff asserted that since the reliction was formed artificially, defendant had no rights in it. The court first found that various statutes did not affect the common law, and stated that if the accretion was formed naturally, defendant had an estate therein. Artificial filling by contiguous littoral owners was found not to alter defendant's riparian rights. Finding that any artificial filling which may have occurred in the disputed reliction was trivial, the court held that the reliction was formed naturally, and that defendant held title thereto. (Hart-Florida)
W71-00509

IRIS V TOWN OF HINGHAM (DIVISION OF FLATS ADJACENT TO RIPARIAN LAND).

22 NE2d 13-17 (Mass 1939).

Descriptors: *Massachusetts, *Boundary disputes, *Accretions (Legal aspects), *Harbors, High water mark, Low water mark, Boundaries (Property), Riparian rights, Riparian land, Riparian waters, Navigable waters, Cities, Condemnation, Parks, Eminent domain, Ownership of beds, Remedies, Judicial decisions, Legal aspects.

Plaintiff riparian landowner brought action to recover damages for property taken by defendant city for a public park. Plaintiff asserted ownership of certain mud flats in a harbor. A colonial ordinance specified that an upland owner's title extended to the low water mark or 100 rods from the high water mark, whichever was the lesser. The court stated that an upland owner was entitled to an equitable portion of adjacent flats, considering in determining the portion of such ownership: (1) the width of upland; (2) the shape of shoreline; (3) the distance between high and low water marks; (4) the contours of the high water mark relative to the low water mark; (5) the length of high and low water marks; and (6) the total area of the flats. The general rule for determination of the division of flats was stated by the court as: (1) where the shoreline is relatively straight, the sidelines of the upland lots comprise the sidelines of the flats; (2) where the shoreline is concave, the sidelines of the flats are convergent; and (3) where the shoreline is convex, the sidelines are divergent. However the court held that when, as in the instant case, the characteristics of the site are unusual, the general rule is inapplicable, and equitable considerations will be used to determine the flat boundaries. (Hart-Florida)
W71-00510

CITY OF NEW YORK V THIRD AVE RY (LANDFILL AND BUILDINGS AS INCLUDED IN RIPARIAN RIGHT OF ACCESS).
294 NY 238, 62 NE2d 52-55 (1945).

Descriptors: *Riparian rights, *River beds, *New York, *Landfills, Usufructuary right, Docks, Railroads, Navigable rivers, Ownership of beds, Riparian land, Riparian waters, Legal aspects, Judicial decisions, Land tenure, Bulkhead line, Coastal structures, Access routes, Right-of-way, Public rights, Cities, Navigation, Transportation.

Plaintiff city brought an action against defendant railway company to recover possession of city property which defendant had filled in adjacent to its riparian land and to recover damages for the use of the land. Plaintiff contended that defendant's filling in of the river bottom and erection of several buildings thereon exceeded its riparian right to 'wharf out' as a means of access to deep water. Defendant argued that its buildings were related to the loading and unloading of freight and were therefore within the scope of its riparian right of access. Affirming a judgment for defendant, the court held that, although the wharfing right is subject to the superior right of the public, defendant's use of the property was reasonable as it was directly related to its freight operations, and there was no interference with any known or contemplated public use. (Liptak-Florida)
W71-00511

GOODWIN V TEXAS CO (LIABILITY FOR DAMAGES FOR SEEPAGE OF COLLECTED WATER AND OBSTRUCTION OF WATER-COURSE).
176 A 873-874 (Me 1935).

Descriptors: *Maine, *Watercourses (Legal), *Obstruction to flow, *Seepage, Diversion, Discharge (Water), Land tenure, Damages, Legal aspects, Judicial decisions, Easements, Flow, Channels, Banks, Beds, Streams, Flood damage, Overflow, Drainage, Relative rights, Dams, Landfills, Freshwater, Saline water, Maps.

Plaintiff landowners brought suit against defendant company for damages which resulted from the flooding of plaintiffs' lands. Defendant had made a landfill with dredgings, and sea water seeped through, overflowing plaintiffs' lands. Defendant had also obstructed a natural watercourse which drained plaintiffs' lands, resulting in more flooding. General verdicts were returned for plaintiffs and defendant appealed. The Supreme Judicial Court of Maine affirmed. Regarding the seepage of seawater from the fill, it is a settled rule that no one may artificially collect water on his land and discharge it unlawfully on his neighbor's property. As to the obstruction of the natural watercourse, it is settled that there is a public or natural easement in a watercourse belonging to all persons whose lands are benefited. It is unlawful to obstruct such watercourse or to divert it to the injury of other proprietors. Evidence supported a finding that defendant had obstructed a watercourse to plaintiffs' injury. (Duss-Florida)
W71-00512

STURTEVANT V FORD (UPSTREAM OWNER LIMITED TO REASONABLE USE OF WATER).
182 NE 560-567 (Mass 1932).

Descriptors: *Massachusetts, *Riparian rights, *Reasonable use, *Mill dams, Relative rights, Natural flow doctrine, Alteration of flow, Dams, Damsites, Obstruction to flow, Streams, Usufructuary right, Damages, Remedies, Flow rates, Fluctuation, Velocity, Water utilization, Water storage, Ponding, Water rights, Judicial decisions, Legal aspects.

In a suit for injunction and damages, plaintiff riparian landowner claimed that defendant upstream owner had unreasonably interfered with his riparian rights in a stream which flowed through both properties. Defendant had constructed and main-

tained small dams designed to produce power to operate mills on his property. However, no mill was erected at one of the dams and plaintiff argued that such storage of water for no reasonable purpose interfered with his riparian rights in that the flow of the stream was greatly diminished thereby. The Supreme Judicial Court of Massachusetts ruled that an upper riparian owner may make reasonable use of water and not be held liable for damages resulting from such reasonable use. The court affirmed the lower court's decision that the storage of water by defendant was unreasonable since no mill was operated thereby. The injunction granted below was upheld as to the one non-functioning dam but the assessment of damages was reversed for further consideration of the proper measurement of such damages. (Barker-Florida)
W71-00513

TICHENOR V HARBISON (DISCHARGE OF OIL WELL OVERFLOW INTO NATURAL WATERCOURSES).
166 NE 927 (Ind Ct App 1929).

Descriptors: *Indiana, *Damages, *Oil wells, *Oil wastes, Riparian rights, Relative rights, Remedies, Judicial decisions, Adjudication procedure, Legal aspects, Brine disposal, Wells, Water pollution sources, Water pollution effects, Groundwater, Wastes, Oily water, Oil, Oil industry, Industrial wastes, Brines, Riparian land, Natural streams, Land.

In an action by plaintiff landowners, seeking a restraining order and damages for the alleged wrongful discharge, into a natural watercourse, by overflows of mineral and salt waters from defendants' oil wells onto the lands of plaintiffs, defendants' demurrer was overruled. The cause was tried by a court without a jury and damages were awarded. Defendants' motion for a new trial was denied. The Appellate Court of Indiana affirmed on the authority of the case of Tichenor v Witherspoon, 87 Ind App 79, 158 NE 514. (Dye-Florida)
W71-00514

SMITH V BAY STATE DREDGING AND CONTRACTING CO (NEGLIGENT POLLUTION OF WATER BY DREDGING UNDER GARBAGE DISPOSAL WHARF).
172 NE 67-68 (Mass 1930).

Descriptors: *Massachusetts, *Docks, *Lobsters, *Water pollution, Watercourses (Legal), Developed waters, Sewage disposal, Garbage dumps, Dredging, Water rights, Judicial decisions, Legal aspects, Waste dumps, Waste disposal, Domestic wastes, Municipal wastes, Damages, Water pollution effects.

Plaintiff stored his lobsters in cars floating at his wharf in Boston. An adjacent wharf was a station for the disposal of garbage. Defendant independent contractor was hired to remove the accumulation of refuse matter under the disposal wharf. In performing his work, defendant polluted the surrounding water and weakened or killed many of plaintiff's lobsters. Plaintiff brought an action for damages to his lobsters caused by defendant's scraping of refuse matter under the garbage disposal wharf. The Supreme Judicial Court of Massachusetts sustained plaintiff's exceptions to the lower court's directed verdict for defendant. The court held that the negligence of defendant, polluting water by dredging under the disposal wharf, and the damaging of plaintiff's lobsters which were in cars in plain sight were proper considerations for the jury. (Powell-Florida)
W71-00515

MCGOWEN V CARR (RIGHT TO UNOBSTRUCTED FLOW OF WATER IN NATURAL WATERCOURSE).
272 Mass 573, 172 NE 787-788 (1930).

Descriptors: *Massachusetts, *Watercourses (Legal), *Ditches, *Obstruction to flow, Artificial watercourses, Channels, Conduits, Drainage, Drains, Water conveyance, Drainage systems, Drainage waters, Outlets, Flow, Watersheds (Basins), Natural flow, Springs, Spring waters, Judicial decisions, Relative rights, Channel flow.

Plaintiff brought an action to restrain defendant from obstructing the drainage flow of water across his land. Plaintiff contended that a ditch system, which transversed the parties' adjoining lands, was a natural watercourse and as such defendant had no right to obstruct the flow of the water in the ditch and cause it to back up upon plaintiff's land. Defendant contended that the ditch system was an artificial one designed to carry surface drainage and as such he was not prohibited from obstructing the ditch upon his property. The court found that the ditch system was a natural watercourse in that it carried off the overflow of various springs above the properties and did not merely carry off surface drainage. The plaintiff, having the right to a free flow of the water of a natural watercourse, was thus entitled to restrain defendant from obstructing such flow. (Snow-Florida)
W71-00516

HEINSE V THORBORG (DIVERSION OF NATURAL FLOW).
230 NW 881-882 (Iowa 1930).

Descriptors: *Iowa, *Obstruction to flow, *Natural flow, *Relative rights, Natural flow doctrine, Depression, Watercourses (Legal), Diversion, Diversion structures, Remedies, Judicial decisions, Legal aspects, Banks, Easements, Overlying proprietors, Surface waters, Surface runoff, Surface drainage.
Identifiers: *Swales.

Plaintiff landowner brought an action in equity to enjoin defendant neighboring landowner from allegedly diverting water onto plaintiff's land. Plaintiff claimed that the natural course of certain surface water was through defendant's land and that defendant had wrongfully diverted the water onto his land. Defendant argued that the natural course was through plaintiff's land and sought to prohibit plaintiff from obstructing such natural flow. The Supreme Court of Iowa found that the natural course was through plaintiff's land, thus making that property the subservient estate of defendant's dominant estate. The court further fuled that the subservient owner was under a duty not to obstruct the natural flow of water from the dominant estate. The trial court's ruling for defendant was affirmed. (Barker-Florida)
W71-00517

KYSER V NEW YORK CENT RR (RIPARIAN RIGHT TO MAKE REASONABLE USE OF RIVER'S WATERS).

151 Misc 226, 271 NYS 182-187 (1934).

Descriptors: *New York, *Water utilization, *Reasonable use, *Riparian rights, Competing uses, Consumptive use, Non-consumptive use, Diversion, Water pollution, Disposal, Impaired water quality, Pollutants, Wastes, Sewage, Water pollution sources, Sewage disposal, Judicial decisions, Rivers, Relative rights, Riparian waters.

Plaintiff brought an action for damages against defendant railroad company, an upper riparian owner, for unreasonable interference with plaintiff's riparian rights. Plaintiff contended that defendant unreasonably diverted waters from a river and discharged unreasonable quantities of sewage therein so as to hinder operation of plaintiff's sawmill located upon the river. Defendant contended that such use was not unreasonable. The court held that a riparian owner has a right to use and enjoy the benefits of a river and that such right includes a right to discharge a reasonable amount of sewage therein and to divert a reasonable quantity of water therefrom. Resultantly, a lower riparian's right to the use of a stream is a right qualified by the rights of upper riparians to make prior reasonable use of the waters. Whether or not use or detention of water by the upper riparian is unreasonable depends upon the peculiar circumstances of each case. From an examination of the evidence, the court found that defendant's diversion was relatively slight and that the sewage discharged was small so as to preclude a claim of unreasonable use. (Snow-Florida)
W71-00518

HOWLAND V UNION BAG AND PAPER CORP (RIPARIAN RIGHTS ATTENDANT TO OWNERSHIP OF NON-NAVIGABLE WATERCOURSE'S STREAMBED).
156 Misc 507, 282 NYS 357-367 (1935).

Descriptors: *New York, *Riparian rights, *Ownership of beds, *Natural flow, Riparian land, Non-navigable waters, Banks, Natural flow doctrine, Alteration of flow, Judicial decisions, Obstruction to flow, Beds, Relative rights, Riparian waters, Streambeds, Streams, Stream flow, Flow, Dams, Backwater.

In an action for damages, plaintiff contended that defendant corporation, by constructing a dam downstream, had violated his riparian right to the natural flow of the stream in that such dam retarded the stream's flow. Defendant contended that plaintiff was not in possession of any riparian rights since a railroad company had condemned for a right of way a portion of plaintiff's land appurtenant to the stream so as to sever any prior existing riparian rights. The court held that the condemnation by the railroad company did not affect plaintiff's riparian rights in that plaintiff still owned the bed of the non-navigable stream so as to entitle him to riparian rights even though he did not now own the bank of the stream. However, plaintiff could recover only nominal damages for the destruction of the riparian right since plaintiff was precluded from using the stream's bank, and thus was precluded from effectively using the stream. (Snow-Florida)
W71-00519

EWANSKI V SOLVAY PROCESS CO (LIABILITY FOR DEPOSITION OF INDUSTRIAL WASTE UPON LAND WHEN STREAM OVERFLOWS).
227 App Div 597, 238 NYS 508-512 (1930).

Descriptors: *New York, *Waste disposal, *Waste water disposal, *Overflow, Streams, Disposal, Wastes, Water pollution sources, Water pollution, Chemical wastes, Industrial wastes, Damages, Water pollution effects, Floods, Judicial decisions, Banks, Legal aspects.

In an action for damages, plaintiff contended that defendant manufacturing company deposited upon his land certain noxious and deleterious matter. Plaintiff contended that defendant discharged manufacturing refuse into a stream and that when such stream overflowed its banks in times of high water, the waste material was deposited on plaintiff's property, thus interfering with plaintiff's use of such property. Defendant recognized liability for such condition, but contended that the measure of damages was erroneously determined. The court held that there was no permanent injury to plaintiff's land and that therefore the effects of the nuisance was to be measured as the difference between the rental value before and after the waste was deposited upon the land. The court remanded the case for a redetermination of damages by such standard. (Snow-Florida)
W71-00520

ADIRONDACK POWER AND LIGHT CORP V CITY OF LITTLE FALLS (RIPARIAN RIGHTS TO UNALTERED RIVER'S FLOW).
For primary bibliographic entry see Field 06D.
W71-00521

CITY OF LOCKPORT V MCCOLLUM (RIGHT OF CITY TO ABATE NUISANCE CAUSED BY OBSTRUCTION TO STREAMFLOW).
235 App Div 106, 256 NYS 283-284 (1932).

Descriptors: *New York, *Obstruction to flow, *Stagnant water, *Abatement, Standing waters, Streams, Streamflow, Flow, Downstream, Judicial decisions, Riparian waters, Riparian land, Public benefits, Public health, Cities, Remedies.

In a per curiam decision, the court ruled that plaintiff municipality could abate a nuisance in the form of stagnant pools which resulted from the failure of defendant, a downstream riparian owner, to clean out a watercourse and remove obstructions which he had placed therein. Plaintiff could remove the obstructions placed in the stream by defendant provided it could be shown that a public nuisance existed. However, the facts before the court were insufficient to establish such a public nuisance, and the case was remanded for a new trial to determine such issue. (Snow-Florida)
W71-00522

HUDSON V CARMICHAEL (INJUNCTION TO PROHIBIT CONTINUED MAINTENANCE OF A DAM).
181 SE 853-856 (Ga 1935).

Descriptors: *Georgia, *Damsites, *Contracts, Backwater, Dams, Streams, Water levels, Weirs, Negotiations, Control, Retardance, Ponding, Reservoirs, Natural flow, Obstruction to flow, Dam construction, Electric power production, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought an injunction against defendant's maintenance of a dam which caused the water in a stream to back up on plaintiff's property. Defendant claimed that she had received permission for such ponding from plaintiff's predecessor in title and had orally contracted with plaintiff for continuing the operation of the dam. Plaintiff argued that such a contract was void because it dealt with an interest in land and as such was covered by the statute of frauds. The injunction was denied by the trial court, but the Supreme Court of Georgia reversed for a new trial, holding that certain testimony concerning the ultimate purpose of the dam being for electric power production was irrelevant and prejudicial to plaintiff's claim. (Barker-Florida)
W71-00523

HOOK V TOWN OF MEBANE (MUNICIPALITY'S LIABILITY FOR DIVERSION AND POLLUTION OF STREAM).
191 SE 407-413 (1926).

Descriptors: *North Carolina, *Water pollution effects, *Damages, *Reasonable use, Water pollution sources, Water pollution, Diversion, Riparian rights, Natural flow, Path of pollutants, Pollutants, Municipal wastes, Sewage odor, Public health, Diseases, Value, Cities, Streams, Remedies, Relative rights, Judicial decisions, Legal aspects.

Plaintiffs, riparian owners, operated a mill on a stream below defendant municipality. Defendant diverted the flow of the stream at one point and discharged sewage into the stream at another, both of which were upstream from plaintiffs' mill. Plaintiffs claimed that such diversion substantially impaired their riparian right to undiminished flow and that the sewage discharge created a nuisance. Defendant argued that the diversion was a reasonable use by an upstream owner and that its sewage system had been approved by proper health officials. The trial court found for plaintiffs and awarded damages for both allegations. The Supreme Court of North Carolina, affirming the lower court's ruling, held that the instructions concerning the riparian right to undiminished flow, subject to the reasonable use of upstream riparian owners, and the evidence concerning the alleged nuisance were properly submitted to the jury. Defendant was liable for the reduction in value of plaintiffs' property. (Barker-Florida)
W71-00524

MOSES V TOWN OF MORGANTON (JOINT LIABILITY OF SEVERAL POLLUTERS).
192 NC, 133 SE 421-424 (1926).

Descriptors: *North Carolina, *Remedies, *Water pollution sources, *Water pollution, Impaired water quality, Path of pollutants, Pollutant identification, Pollutants, Riparian rights, Wastes, Industrial wastes, Odor, Water pollution effects, Fishkill, Fouling, Color, Aesthetics, Effluents, Municipal wastes, Damsites, Dams, Cities, Organic wastes, Judicial decisions, Legal aspects.

Plaintiff landowner brought suit against defendants, a municipality, an electric power corporation, and a shoe manufacturer, for damages caused to a stream on plaintiff's property. Plaintiff claimed that the city had discharged effluents from its sewer system into the river and that the shoe company had emptied noxious animal remains into the creek above plaintiff's land. The power company had constructed a dam below plaintiff's property thus retarding the flow of the water and causing the waste matter to accumulate on plaintiff's land. Plaintiff brought one action against all three defendants, and defendant shoe company, an out of state corporation, sought removal to federal court on the grounds that defendants were not joint tort-feasors. The Supreme Court of North Carolina ruled that if parties, although acting independently, know or have reasonable ground to believe that their independent acts, combined with the independent acts of others, will create a result that will become a nuisance, and they do so cause damage, they become joint tort-feasors ab initio and are liable as joint tort-feasors. The removal was denied. (Barker-Florida)
W71-00525

LINEBERGER V RUBY COTTON MILLS, INC (INJUNCTION AGAINST SEWER MAINTENANCE).
146 SE 215-216 (NC 1929).

Descriptors: *North Carolina, *Sewers, *Damages, *Sewage disposal, Sewage effluents, Riparian waters, Streams, Riparian rights, Relative rights, Industrial plants, Industrial wastes, Water pollution, Water pollution sources, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought an injunction against defendant corporation's maintenance of its sewers whereby sewage was allegedly discharged into a creek which ran through plaintiff's land. Defendant argued that what damage may have been done to plaintiff's land and the creek was the result of action by others and that defendant was in no way connected to such damage. The trial court denied the injunction and the Supreme Court of North Carolina affirmed, saying that plaintiff had not met the burden of showing the trial court's finding of facts to be erroneous. (Barker-Florida)
W71-00526

ANDERSON V TOWN OF WAYNESVILLE (MUNICIPALITIES' LIABILITY FOR POLLUTION CAUSED BY SEWAGE DISCHARGE).
164 SE 583-88 (NC 1932).

Descriptors: *North Carolina, *Sewage disposal, *Water pollution, *Remedies, Water pollution sources, Water pollution effects, Damages, Impaired water quality, Path of pollutants, Pollutant identification, Pollutants, Wastes, Municipal wastes, Odor, Aesthetics, Effluents, Sewage, Cities, Lakes, Streams, Public health, Bacteria, Sewage baceria, Judicial decisions, Legal aspects.

Plaintiffs, a church corporation and several individuals, owned a lake used for church functions and various recreational activities. Defendant municipalities operated sewage systems which discharged raw sewage into a stream which emptied into the lake, thus causing severe pollution and a threat to health. Plaintiffs sought damages for the past actions of defendants and injunctions, both temporary and permanent, against further pollution of the lake. The trial court granted the relief sought, but the Suprme Court of North Carolina reversed. It was held that the facts determined by the lower court were not reviewable and that plaintiffs had not lost their cause of action by laches. However, the court held that only a preliminary mandatory injunction could be granted pending a ruling by the jury on the defendants' liabilities to plaintiffs for the alleged nuisance. (Barker-Florida)
W71-00527

WATKINS V PEPPERTON COTTON MILLS (PRESCRIPTIVE RIGHT TO DUMP SEWAGE).
134 SE 69-71 (Ga 1926).

Descriptors: *Georgia, *Water pollution, *Prescriptive rights, *Streams, Water pollution sources, Wastes, Water pollution effects, Abatement, Sewage effluents, Cesspools, Sewage disposal, Industrial plants, Legal aspects, Judicial decisions, Sewage sludge, Damages.

Plaintiff landowner sought an injunction against defendant cotton mills to prevent defendant from continuing to use its sewage system which emptied raw sewage into the creek which flowed across plaintiff's land. Plaintiff contended that defendant's sewage system was polluting the creek which plaintiff used for a public bathing pool and whose water plaintiff used for domestic purposes. Defendant contended that it had poured sewage into the creek at a point miles above the point at which it flowed into plaintiff's land for 26 years prior to the action and had thus acquired a prescriptive right to do so. Furthermore, defendant contended tat it was not the source of the pollution because its raw sewage would be purified by the time the creek reached plaintiff's land. The Supreme Court of Georgia held that defendant had acquired a prescriptive right to dispose of its sewage in the creek. (Quesada-Forida)
W71-00528

MOBILE AND O RR V RED FEATHER COAL CO (LIABILITY FOR OBSTRUCTION TO FLOW OF INTERMITTENT STREAM).
119 So 606-610 (Ala 1928).

Descriptors: *Alabama, *Riparian rights, *Embankments, *Flood damage, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Natural flow doctrine, Proprietary power, Relative rights, Riparian land, Riparian waters, Usufructuary right, Watercourses (Legal), Damages, Excess water (Soils), Surface waters, Floods, Intermittent streams, Alteration of flow.

Defendant railroad's right-of-way crossed a stream which flowed across plaintiff's land on which several coal mine shafts were located. Defendant's trestle located on such right-of-way did not obstruct the streamflow until defendant constructed an earth embankment across the stream. The stream overflowed during 3 separate rainstorms as a result of said embankement, causing plaintiff's wells to be damaged by floodwater. Among other affirmative defenses, defendant offered proof that the stream was intermittent, being dry part of the year. The court held that injuries caused by obstructing and diverting the flow of waters constitute a private nuisance and are actionable as such. It further held that diverting waters from an intermittent stream is governed by the same rules of law as diverting those of a running stream. Defendant was granted a new trial, however, on the grounds that plaintiff had failed to mitigate his damages. (Clarke-Florida)
W71-00529

GREEN V PELICAN NATURAL GAS CO (DAMAGES FROM OIL WASTES).
163 So 431-433 (La 1935).

Descriptors: *Louisiana, *Damages, *Oil wastes, *Brine disposal, Boundaries (Property), Judicial decisions, Legal aspects, Land tenure, Proprietary power, Relative rights, Riparian rights, Watercourses (Legal), Discharge (Water), Oil wells, Flooding, Flood damage, Intermittent streams, Saline water, Overflow.

Defendant drilled oil wells near plaintiff's land. Salt and waste water from the wells caused an intermittent branch stream across plaintiff's land to overflow, thus destroying a small amount of pasture and timber. The court recognized plaintiff's right to damages for injuries to his land caused by such overflow. The court limited damages, however, to the value of the timber actually destroyed. The court found that there was no material decrease in the fair market value of the land because the slight damage to the pasturage was temporary. (Clarke-Florida)
W71-00530

RHODES V INTERNATIONAL PAPER CO (LIABILITY FOR DAMAGES CAUSED FOR DISCHARGE OF INDUSTRIAL WASTES).
174 La 49, 139 So 755-757 (1932).

Descriptors: *Louisiana, *Pulp and paper industry, *Pulp wastes, *Damages, Chemical wastes, Watercourses (Legal), Crop response, Waste water (Pollution), Chemicals, Flooding, Usufructuary right, Overflow, Basins, Pollutants, Pollutant identification, Creeks, Drainage water, Waste water disposal, Legal aspects, Judicial decisions, Water pollution.

Plaintiff landowner sought damages for injury to her land allegedly caused by defendant paper company's pollution of a stream traversing her property. Defendant contended that plaintiff had failed to prove that the damage to her property was due to the chemical wastes it emtied into the stream. After considering the record, the court held that plaintiff had failed to meet the required burden of proof. The judgment for plaintiff was set aside, and plaintiff's demands were rejected. (Price-Florida)
W71-00531

BOARD OF LEVEE COMM'RS V MANGUM (RIGHT TO HAVE STREAM FLOW IN NATURAL COURSE MAY BE EXPRESSLY OR IMPLIEDLY WAIVED).
153 So 820-823 (Miss 1934).

Descriptors: *Mississippi, *Pumping plants, *Flow augmentation, *Erosion, Alteration of flow, Levees, Flood control, Flooding, Flood prevention, Judicial decisions, Legal aspects, Watercourses (Legal), Mississippi River, Top soil Water level fluctuations, Seepage, Floodwater, Drainage programs, Riparian land, Riparian waters, Riparian rights, Flow rates.

Plaintiff landowner sought damages for erosion to his property caused by the increased velocity of the stream flow generated by defendant's pumping plant. Defendant contended plaintiff was estopped from recovering because he had requested that the capacity of the pumping station be increased and had acquiesced and consented to the construction of the plant. The court stated that the undoubted right of a riparian owner to have the free use of the flow of water through his lands may be waived, and he may so act as to be estopped from asserting his claim to damage because of the alteration of the course or manner of the flow f the water. This license may be implied or given in parol. The court held that plaintiff was so estopped, and the trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-00532

JOHNSON V GIFFORD-HILL AND CO (LIABILITY FOR CHOKING OF STREAM CAUSED BY DEPOSITION OF SEDIMENT).
175 La 806, 141 So 842 (1932).

Descriptors: *Louisiana, *Water demand, *Deposition (Sediments), *Damages, Gravels, Watercourses (Legal), Judicial decisions, Legal aspects, Crop response, Relative rights, Riparian land, Riparian waters, Riparian rights, Sands, Streams.

Plaintiff landowner sought damages for crop loss, diminution in the value of his land, and loss of the operation of his cane mill. Such losses allegedly were cuased by the deposition of sand from defendant's gravel mill which choked the stream flowing by plaintiff's property. The court stated that there was little doubt as to defendant's liability, but that plaintiff took his damages too seriously. The five hundred dollars granted at the trial court was deemed sufficient to remedy plaintiff's water loss via the drilling of a well, and there would be some left over to compensate plaintiff for his crop disappointment. The trial court's judgment was affirmed. (Price-Florida)
W71-00533

GUILLORY V FONTENOT (PROPER USE OF FLOODGATES NOT AN OBSTRUCTION TO NATURAL DRAINAGE OF LAND).
170 La 345, 127 So 746-748 (1930).

Descriptors: *Louisiana, *Floodgates, *Flood irrigation, *Obstruction to flow, Watercourses (Legal), Drainage, Flooding, Irrigation, Impounded waters, Impoundments, Lakes, Diversion structures, Cultivated lands, Cultivation, Water storage, Artificial watercourses, Legal aspects, Judicial decisions.

Plaintiff upper landowner brought suit to have defendant lower landowner remove floodgates which allegedly obstructed the natural drainage of his property. Defendant contended that his floodgates were properly constructed and properly supervised during use, that his gates were never used until after plaintiff's lands were drained and that the use of his gates had never caused plaintiff damage. The court found that defendant's floodgates in no way impeded the current in the stream, that the gates were constructed by defendant's father at the request and with the consent of plaintiff and that plaintiff was now trying to evade the lawful contract he had previously entered with defendant's father. The judgment for defendant was affirmed. (Price-Florida)
W71-00534

WHEELER V RIVER FALLS POWER CO (LIABILITY OF POWER COMPANY FOR VIOLATION OF BOARD OF HEALTH'S REGULATIONS).
111 So 907-910 (Ala 1926).

Descriptors: *Alabama, *Diversion dams, *Impoundments, *Public health, Watercourses (Legal), Dams, Legislation, Impounded waters, Non-navigable waters, Diversion structures, Legal aspects, Judicial decisions, Regulation, Standards, Supervisory control (Power), Administrative agencies, Public utilities.

Plaintiff brought action against defendant power company alleging that the construction of a dam and impoundment of water by defendant was in violation of regulations of the state Board of Health and that such violations had caused plaintiff to become sick, and to suffer physical pain and mental anguish. The court stated that defendant was a corporation with the statutory power to construct dams and divert water from a non-navigable stream (as was involved in the instant case) if done in accordance with the regulations of the state Board of Health. However, the regulations allegedly violated were passed by a minority of the Board and were therefore invalid. The trial court's judgement for defendant was affirmed. (Price-Florida)
W71-00535

NAUVOO BLACK CREEK COAL CO V JOHNSON (LIABILITY FOR SUBSTANTIAL INJURY CAUSED BY STREAM POLLUTION).
For primary bibliographic entry see Field 05C.
W71-00536

STANDARD OIL CO V GOODWIN (FOULING OF LANDS BY ESCAPE OF SEDIMENT FROM STORAGE TANKS).
299 SW 2-5 (Ark 1927).

Descriptors: *Arkansas, *Damages, *Sediment discharge, *Sediment distribution, Watercourses (Legal), Levees, Oil, Pollutants, Pollutant identification, Riparian land, Riparian rights, Riparian waters, Oil fields, Oily water, Embankments, Fouling, Judicial decisions, Legal aspects, Industrial wastes.

Plaintiff landowner sought damages for injury to his property allegedly caused by the escape of crude oil and basic sediment from defendant oil company's storage pits. The sediment was carried across plaintiff's land via a natural watercourse. Defendant denied plaintiff's allegations and contended that any damage to plaintiff was temporary. Defendant also contended that the measure of damages, if any, should be the difference between the rental value of the land before and after the sediment deposition. The court held that the injury was permanent. The court ruled that the proper measure of damages was the difference between the fair market value of the land prior to and after the injury. The judgment for plaintiff was affirmed. (Price-Florida)
W71-00537

CHAPMAN V AMERICAN CREOSOTING CO (LIABILITY FOR POLLUTION OF WELLS AND SPRINGS).
286 SE 837-841 (Mo 1926).

Descriptors: *Missouri, *Creosote, *Water pollution sources, *Industrial wastes, Wastes, Water pollution control, Springs, Wells, Deepwells, Legal aspects, Judicial decisions, Waste water treatment, Subsurface waters, Remedies, Pollutants, Damages, Overflow.

Plaintiff landowner brought an action for damages against defendant corporation which plaintiff contended was polluting his well and spring by discharging creosoting wastes. Plaintiff contended that defendant negligently maintained its creosoting vats and that it allowed poisonous fluids to overflow into a ravine which led into plaintiff's land. Plaintiff sought damages for destruction of his grazing land, his water sources and his livestock, asserting that the waste products in his water sources were the proximate causes of such damage. Defendant contended that the overflow was caused by an unforeseen, unusually heavy rainfall which was an act of God. In holding for plaintiff, the court found that there was no evidence of extraordinary rainfall and that there was sufficient evidence upon which it could be found that defendant's creosote wastes had polluted plaintiff's wells and springs. (Quesada-Florida)
W71-00538

GREISINGER V KLINHARDT (IMPLIED EASEMENT FOR THE MAINTENANCE OF WATER LEVEL OF LAKE IN UPLAND LANDOWNER).
9 SW2d 978-983 (Mo 1928).

Descriptors: *Missouri, *Water levels, *Dams, *Easements, Concrete structures, Legal aspects, Judicial decisions, Diversion, Remedies, Diversion structures, Competing uses, Recreation, Relative rights, Riparian rights, Lakes, Overlying proprietor.

Plaintiff upper riparian landowner sought to enjoin defendant lower riparian landowner from draining the waters of an artificial lake. Plaintiff contended that a common grantor of plaintiff and defendant had constructed the dam which divided the lake

nto two parts, one of which was later sold to plain-tiff. Plaintiff further contended that by such divi-sion, the grantor had burdened the lower land and created an implied easement for the maintenance of the water level in the lake in favor of the upper andowner upon severance of the two portions by ale. Defendant contended that he was draining the water from the upper portion only to the extent necessary to effect repairs in the dam. The Supreme Court of Missouri held that plaintiff had acquired such an implied easement, and, upon find-ng that defendant had not in good faith lowered he level of the lake, issued an injunction prohibit-ng defendant from any further draining activities. (Quesada-Florida)
W71-00539

ATONIA REFINING CORP V DUSING (OIL REFINERY LIABLE FOR STREAM POLLU-TION).
46 Ky 328, 55 SW2d 23-26 (1932).

Descriptors: *Kentucky, *Damages, *Industrial wastes, *Water pollution, Water injury, Pollutant identification, Watercourses (Legal), Non-naviga-le waters, Creeks, Oily water, Legal aspects, Judi-ial decisions, Oil, Oil industry, Oil wastes, Water emand, Pollutants, Relative rights, Water pollu-on effects.

Plaintiff landowner sought damages for defendant il refinery's pollution of a stream which flowed hrough his property. Defendant emptied oily water nto the stream. During heavy rans, such water was ashed away and no accumulation occurred on the tream surface. During the year involved there was drought, and considerable pollution occurred. Defendant contended the pollution was an act of God. Had it rained as usual, no pollution would ave resulted from its actions. Defendant also con-ended there was no other way to operate its busi-ess and that adjoining landowners must yield to ome inconvenience caused by the use of its pro-erty. The court stated that one cannot provide the onditions for a disaster and then claim it was an ct of God. The court did not concede that defen-ant had a right to pollute the non-navigable tream on which it was located. The business was rought to the land, not placed there by nature, and o public necessity required t to be there. Damages ere held to be that amount necessary to fairly and easonably compensate plaintiff for the diminution the value and use of his property. The judgment r plaintiff was affirmed. (Price-Florida)
W71-00540

ORTON COAL MIN CO V WILKEY (POLLU-ION OF STREAM AND FARM BY COAL MIN-NG WASTES).
32 Ky 539, 23 SW2d 942-945 (1930).

escriptors: *Kentucky, *Water pollution, Streams, *Coal mine wastes, Farms, Agriculture, rops, Crop production, Water pollution sources, Vater pollution effects, Pollutants, Coal mines, ydraulic mining, Rent, Economic rent, Compen-tion, Legal aspects, Judicial decisions, Adjudica-on procedure, Industrial wastes.

aintiff landowner sued defendant coal mining mpany for damages from pollution injury. A ream coursed through plaintiff's land, and defen-nt discharged coal mining wastes into the stream. aintiff claimed damages for injury to his farm and ops caused by this pollution of the creek. In an peal on procedural issues, the court held that the idence presented was a sufficient standard for easuring damages, and that the damages awarded ere not excessive. The decision of the lower court r plaintiff was affirmed. (Hart-Florida)
71-00541

UNZE V CITY OF CAPE GIRARDEAU (LIA-LITY FOR STREAM POLLUTION BY MU-ICIPALITY).
SW2d 882-883 (Mo 1931).

Descriptors: *Missouri, *Water pollution, *Ease-ments, *Condemnation, Eminent domain, Sewers, Cities, Water pollution effects, Water pollution sources, Pollutants, Surface runoff, Storm drainage, Judicial decisions, Legal aspects, Adjudi-cation procedure, Runoff, Storm runoff, Excess water (Soils), Sewage effluents, Municipal wastes, Sewage disposal.
Identifiers: *Nuisance.

Plaintiff landowner sued defendant city for damages from pollution. Defendant condemned an easement across plaintiff's land to install a sewer line, and also condemned an easement in a stream which crossed plaintiff's land for the discharge of excess surface water mixed with sewer effluent in times of heavy rainfall. The sewer clogged, and de-fendant diverted the sewer into the stream continu-ously, surcharging the stream easement. Defendant contended that the condemnation proceeding was res judicata to the instant action, and that proof of negligence was required for the recovery of damages. The court held that since the instant ac-tion was only for damages resulting from the ease-ment surcharge, the condemnation proceeding was not res judicata. Furthermore, the court held that in actions for damages for injury from creation of a nuisance, proof of negligence was not required, and affirmed the lower court's judgment for plaintiff. (Hart-Florida)
W71-00542

SHELLEY V OZARK PIPELINE CORP (CHARACTERIZATION OF OIL PIPELINE LEAK AS TEMPORARY OR PERMANENT NUISANCE).

37 SW2d 518-523 (Mo 1931).

Descriptors: *Pipelines, *Oil, *Water wells, *Mis-souri, Water pollution sources, Oil industry, Oily water, Water pollution, Pollutants, Legal aspects, Judicial decisions, Adjudication procedure, Groundwater, Wells, Water supply, Damages, Compensation, Remedies, Farm ponds, Stock water, Leakage.
Identifiers: *Oil leaks.

Plaintiff farmers brought an action against defen-dant oil company to recover damages caused by oil leaking from defendant's pipeline on plaintiffs' pro-perty, thereby contaminating plaintiffs' water supply. Plaintiffs had already recovered in a prior action for similar damage but contended that a new leak had caused further damage since the prior ac-tion. Defendant argued that plaintiffs had alleged in the first action that the oil damage was a permanent nuisance and therefore were barred from bringing another action since they should have recovered all their damages in the first action, although they only recovered in part. Reversing a judgment for defen-dant, the court held that a pipeline leak was a tem-porary, rather than a permanent nuisance despite plaintiffs' allegations to the contrary. Therefore, plaintiffs could not have recovered for future damages in the first action and were not barred from bringing a second action. (Liptak-Florida)
W71-00543

CALIFORNIA OREGON POWER CO V BEAVER PORTLAND CEMENT CO (UNAP-PROPRIATED WATER UNDER THE DESERT LAND ACT AS SUBJECT TO STATE RULES OF APPROPRIATION).

295 US 142, 55 S Ct 725-732 (1935).

Descriptors: *Desert Land Act, *Appropriation, *Water rights, *Unappropriated water, Beneficial use, Public lands, Non-navigable streams, Govern-ments, Natural flow, Riparian rights, Legal aspects, Judicial decisions, United States, Reservation doc-trine, State jurisdiction, Arid lands, Reclamation, Obstruction to flow, Federal jurisdiction.

Plaintiff power company sued to enjoin defendant cement company from interfering with the natural flow of a stream which flowed between plaintiff's and defendant's property. Plaintiff argued that its patent from the United States carried with it the riparian right to the uninterrupted flow of water past its property. Defendant contended that, except for previously exercised rights, state legislation had established the rule of prior appropriation and since plaintiff had not put the water to any benefi-cial uses, defendant's right of appropriation was not restricted. Affirming a judgment for defendant, the court held that the Desert Land Act, establishing a rule of appropriation as to unappropriated water, was not binding upon the states. The final choice of a rule was left to the individual states. Therefore, the state court's interpretation of its own rule as one of appropriation, rather than one of riparian rights must stand. (Liptak-Florida)
W71-00544

BRAIDBURN REALTY CORP V CITY OF EAST ORANGE (WITHDRAWAL OF GROUND-WATER FROM CONDEMNED PROPERTY AS AN ELEMENT OF DAMAGES).
153 A 714-716 (NJ 1931).

Descriptors: *New Jersey, *Groundwater, *Draw-down, *Condemnation value, Water supply, Cities, Wells, Eminent domain, Percolation, Damages, Compensation, Legal aspects, Judicial decisions, Water table, Withdrawal, Consumptive use, Water demand, Legislation, Assessments, Relative rights.

Defendant city condemned plaintiffs' land primari-ly for the purpose of withdrawing the groundwater beneath the property to augment the city water supply. Plaintiffs claimed that they were entitled, not only to the value of the land taken, but also to damages to injury to their adjoining property resulting from the drawdown of the water level. The court held the plaintiffs, as condemnees, were entitled to recover for damage to their remaining land resulting from any use to which the con-demned land was to be put. Therefore, to the ex-tent that the withdrawal of water from the con-demned property interfered with plaintiffs' reasonable use of the groundwater subjacent to their remaining property, recovery was allowed. The case was remanded to the lower court for as-sessment of these damages. (Caldwell-Florida)
W71-00545

WHITE RIVER CHAIR CO V CONNECTICUT RIVER POWER CO (DEFENDANT'S DAM AL-LEGED TO HAVE RAISED WATER LEVELS, FLOODING PLAINTIFF'S PROPERTY).
162 A 859-872 (Vt 1932).

Descriptors: *Vermont, *Dams, *Seepage, *Sub-surface drainage, Flood damage, Overflow, Hydroelectric plants, Damages, Water levels, Dikes, Percolation, Legal aspects, Drainage, Groundwater movement, Saturation, Structures, Slopes, Relative rights, Flooding, Obstruction to flow, Judicial decisions, Subsurface flow, Diver-sion, Drainage effects.

Plaintiff corporation claimed that defendant power company's dam had so raised the water levels in the surrounding area as to cause seepage onto plain-tiff's property. Also, the natural drainage of the property was alleged to have been interfered with, resulting in plaintiff's basement being flooded and the soil being saturated. The court found no evidence to support plaintiff's claim that the dam had caused seepage directly onto the property from the dam's millpond. A lower court finding that dikes built to keep water from overflowing onto plaintiff's property were impervious to percolation was upheld. Plaintiff's contention that interference with the natural drainage of groundwater gave ground for relief was also rejected by the court, holding that rules granting recovery for obstruction of surface drainage did not apply to groundwater movement. Defendant was entitled to overflow his property up to the boundary with plaintiff's land, and any effect of such overflow on subsurface drainage was held non-compensable. (Caldwell-Florida)
W71-00546

JESSOP V PASSAIC VALLEY WATER COMM'N (PRIOR APPROPRIATION BY PREDECESSOR IN INTEREST ESTABLISHED ADVERSE USE WHICH PASSED TO SUCCESSOR).
174 A 254-257 (NJ 1934).

Descriptors: *New Jersey, *Prior appropriation, *Diversion, *Riparian rights, Relative rights, Reasonable use, Legal aspects, Judicial decisions, Competing uses, Consumptive uses, Water allocation (Policy), Water distribution (Applied), Water utilization, Industrial water, Water users, Natural flow, Water demand.

Plaintiff riparian landowner sought to enjoin defendant water commission from diverting water from the river at a point above where plaintiff diverted water for commercial uses. Plaintiff contended that defendant was interrupting the natural flow of the river and that it should cease such interruption or cause plaintiff's land to be condemned. Defendant claimed a prescriptive right to divert the water as the successor in title of a water company. The Court of Chancery of New Jersey haeld that while the period during which the predecessor to defendant diverted water could not be counted as part of any prescriptive period, the use of the water was competent evidence to show to what extent defendant's predecessor had acquired diversion rights by adverse use. On this basis, the court held that plaintiff was entitled to an injunction against a diversion in excess of the amount which defendant had acquired the right to divert from its grantor. (Quesada-Florida)
W71-00547

CITY OF JOHNSTOWN V FEARL (ATTEMPT BY CITY TO REMOVE STRUCTURES WITHIN CHANNEL LINES OF STREAM).
176 A 20-22 (Pa 1935).

Descriptors: *Pennsylvania, *Obstruction to flow, *Cities, *Structures, Legislation, Channel flow, Ownership of beds, Non-navigable waters, Boundary disputes, Boundaries (Property), Legal aspects, Eminent domain, Channels, Channel improvement, Riparian land, Condemnation, Compensation.

Plaintiff city sought, by having them declared a public nuisance, to remove structures constructed by defendant within the channel lines of a river. The court held that the structures were not public nuisances, and that defendant could not be forced to remove them through abatement proceedings. The proper procedure was for the city to condemn defendant's property and remove the structures after it had gained title to the land. Because the stream was non-navigable, defendant's property extended to the middle of the stream. The fact that a statute had declared the stream to be a public waterway was held not to have deprived defendant of his title to the streambed. The value of this property had to be taken into account in any future condemnation action. (Caldwell-Florida)
W71-00548

PURYEAR V NIELSON (EFFECTS OF SURFACE WATER DIVERSION ON ADJACENT LANDOWNER).
211 NW 676-677 (Minn 1927).

Descriptors: *Minnesota, *Damages, *Storm runoff, *Diversion structures, Surface waters, Ditches, Diversion, Sand pits, Runoff, Gravel, Flooding, Floodwater, Dikes, Topography, Basins, Judicial decisions, Legal aspects, Diversion losses, Surface runoff, Relative rights.

Plaintiff sued defendant for damages alleged to have resulted from defendant's construction of a ditch and dike to protect his premises from surface water. The court ruled that there was too much evidence indicating that water would have gone onto plaintiff's property, and his buildings surrounded by water, even if no ditch or dike had been constructed. The burden was on plaintiff to show not only his damage, but also that defendant's ditch was the cause of such damage. Since plaintiff failed to so prove, the judgment for plaintiff was reversed. (Price-Florida)
W71-00549

BESLER V GREENWOOD (INJUNCTION TO PREVENT OBSTRUCTING NATURAL FLOW OF DRAINAGE WATER).
For primary bibliographic entry see Field 04A.
W71-00550

6F. Nonstructural Alternatives

FLOOD DAMAGE ABATEMENT-FEDERAL ASSISTANCE TO LOCAL GOVERNMENT.
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.

Virginia Polytechnic Institute and State University Water Resources Center Bulletin 39, July 1970. 138 p, 3 append. OWRR Project A-999-VA (9).

Descriptors: *Flood control, *Flood plain zoning, *Planning, *Virginia, Cities, Urbanization, Flood protection, Economics, Surveys, Hydrologic data, City planning, Area redevelopment, Governments, Legislation, Non-structural alternatives.
Identifiers: Flood plain planning.

To assist local governments in Virginia in coping with flood problems, the Virginia Water Center organized a seminar to show that something could be done at the local level, to highlight the economics associated with flooding, to provide detailed information about the federal and state assistance available, and to hear the testimony of community leaders who have reduced their flood losses with the financial and technical assistance available. This bulletin contains the papers presented at the seminar. (Knapp-USGS)
W71-00002

FLOOD PLAIN INFORMATION, MINNESOTA RIVER, GRANITE FALLS, MINNESOTA.
Corps of Engineers, St Paul, Minn.
For primary bibliographic entry see Field 04A.
W71-00026

FLOOD PLAIN INFORMATION, BEARGRASS AND UPPER MILL CREEKS, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-00054

FLOOD PLAIN INFORMATION, MISSISSIPPI RIVER AND CAPE LA CROIX CREEK, CAPE GIRARDEAU, MO.
Corps of Engineers, St. Louis, Mo.
For primary bibliographic entry see Field 04A.
W71-00055

FLOOD PLAIN INFORMATION, OHIO RIVER, KENTON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-00065

FLOOD PLAIN INFORMATION, OHIO RIVER, CAMPBELL COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-00066

FLOOD PLAIN INFORMATION, FLORENCE, SOUTH CAROLINA.
Corps of Engineers, Charleston, S.C.
For primary bibliographic entry see Field 04A.
W71-00067

FLOOD PLAIN INFORMATION, SANTA YNEZ RIVER (LOMPOC TO PACIFIC OCEAN), SANTA BARBARA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W71-00208

FLOOD PLAIN INFORMATION, WHITE OAK CREEK, ROCK CREEK AND TOWN BRANCH, SULPHUR SPRINGS, TEXAS.
Corps of Engineers, New Orleans, La.
For primary bibliographic entry see Field 04A.
W71-00224

THE LOCAL-STATE-FEDERAL TEAM APPROACH TO FLOODPLAIN MANAGEMENT,
Tennessee Valley Authority.
John W. Weathers.
In: Water Resources Bulletin, Vol 6, No 1, February 1970, p 106-109.

Descriptors: *Planning, *Coordination, *Flood plains, State governments, Cities, Institutions, Federal government, Non-structural alternatives, Tennessee River, Tennessee Valley Authority Project, Land management.
Identifiers: *Flood plain management, *Flood plain information.

Results of the establishment of a local Flood Relations program in 1953 by TVA are discussed. In sixteen years, TVA has produced local flood plain information reports for 126 communities. As of September 1, 1969, 66 valley communities had adopted both. The local-state-federal team approach to floodplain management is viable and any other appears to be doomed to failure. The floodplain management program can be expected to succeed as a collaborative effort by all levels of government, each playing a part and assuming the responsibilities best fitted to it. Most of us now accept that our flood problems will not be solved by engineering works alone or even in combination upstream land management. The solution requires a linking of broad community planning with traditional engineering works. This means that the local, state and federal objectives and policies must be effectively coordinated. This method has been developed and satisfactorily applied in the Tennessee Valley during the past decade. Since a working relationship with the people of the Valley and their state and local institutions had been carefully nutured for by TVA for over twenty years, it was only natural that the new program would also be a cooperative one. (Marriott-Chicago)
W71-00313

FLOOD CONTROL AND DRAINAGE IN INDIA,
Central Water and Power Commission, New Delhi, (India).
For primary bibliographic entry see Field 04A.
W71-00400

REMOTE SENSING FOR RESOURCE MANAGEMENT AND FLOOD PLAIN DELINEATION,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 07B.
W71-00415

6G. Ecologic Impact of Water Development

RANGE AND WILDLIFE HABITAT EVALUATION--A RESEARCH SYMPOSIUM,
Harold A. Paulsen, Jr., and Elbert H. Reid.
Department of Agriculture Miscellaneous Publication No 1147, May 1970. 220 p.

Descriptors: *Wildlife habitats, *Habitat imporvement, *Remote sensing, *Range management, *Ecology, Grazing, Pasture management, Soil conservation, Carrying capacity, Conservation, Ranges, Grasslands, Land use, Wildlife management, Surveys, Investigations, Data collections.

dentifiers: Range and wildlife habitat surveys.

A symposium collection of 30 papers discusses valuation of range and wildlife habitat. The major opics discussed include: forage evaluation for ivestock and wildlife, remote sensing, and status, pplications, and research needs in range and wilife ecology. The papers are presented in the folowing sections: animal production and forage uality, factors influencing forage quality, deterining forage quality, determining animal conumption, remote sensing, and range and wildlife abitat ecology-status and challenges. (Knapp-USGS)
W71-00209

07. RESOURCES DATA

7A. Network Design

HE ARCHIVES FOR GROUNDWATER EVELS T.N.O. IN THE NETHERLANDS,
ijksinstituut voor Drinkwatervoorziening, Delft Netherlands).
or primary bibliographic entry see Field 02F.
V71-00144

PROPOSED STREAMFLOW DATA PROGRAM FOR MICHIGAN,
Geological Survey, Lansing, Mich.
or primary bibliographic entry see Field 02E.
V71-00199

7B. Data Acquisition

DETECTION AT A DISTANCE OF EMERGENCE OF THE GIRONDE BY INFRARED RADIOMETRY. RELATIONS WITH THE COASTAL DRAINAGE CHANNELS (IN FRENCH),
Alain Cazal, Pierre Pouchan, and Jean Vouve.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 6, Serie D, p 760-763, 1970. 1 fig, 4 ref.

Descriptors: *Analytical techniques, Spectroscopy, Infrared radiation, Remote sensing, Underground streams, Water, Temperature, Rivers, Hydrogen ion concentration, Estuaries, Water circulation.
Identifiers: River temperature bands, Thermal profiles, Gironde Estuary (France), Seudre River (France), Radiometry.

The use of the infrared radiometry permitted the detection of the enrichment of the Gironde estuary by hard water of underground currents possessing a higher temperature than that of the estuary. The equipment included a radiometer recording infrared radiation with wave length between 8 and 14 microns. A continuous recording of data registered by an airborne thermometric device was effected photographically. The assembly was equipped with a system of differential amplification and provided a sensibility of 0.05C. The technique encountered several obstacles, such as adjustment or calibration difficulties, complications due to currents of diversified nature, high air humidity, and limitations connected with the recording of solely surface temperatures. Nevertheless, the study was able to reveal the pattern of circulation of water flowing from the important network of the karstian plateau. (Wilde-Wisconsin)
W71-00111

DETERMINATION OF ORGANIC MATTER BY PERMANGANATE OXIDATION. XIII. CONTRIBUTION TO THE DETERMINATION OF OXIDABILITY OF PHENOLIC WATERS (IN CZECHOSLOVAKIAN),
Charlova Universita, Prague (Czechoslovakia).
Antonin Berka, and Zdenek Zavesky.
English summary. Chemicke Listy, Vol 63, p 1148-1152, 1969. 3 tab, 8 ref.

Descriptors: *Organic matter, *Water analysis, *Analytical techniques, *Oxidation, Phenols, Analysis, Chemistry, Effluents.
Identifiers: Potassium permanganate, Sodium carbonate, Sulfuric acid, Oxalic acid.

The oxidation of phenol containing substances by permanganate was conducted in 1 mole solution of sodium carbonate and subsequently in a solution acidified by sulfuric and oxalic acids. In a simplified version of the procedure, the titration is accomplished with 0.1 mole fraction potassium permanganate. The described method achieves a significantly higher degree of oxidation of phenolic compounds in comparison with the 4-hour iodometric analyses. (Wilde-Wisconsin)
W71-00113

PERMEABILITY OF CRYSTALLINE ROCK INTERPRETED FROM MEASURED ORIENTATIONS AND APERTURES OF FRACTURES,
Ceara Univ., Fortaleza (Brazil). Dept. of Geosciences; and Colorado School of Mines, Golden.
Luiz Bianchi, and David T. Snow.
Annals of Arid Zone, Vol 8, No 2, p 231-245, September 1969. 13 fig, 2 tab, 14 ref.

Descriptors: *Permeability, *Crystalline rocks, *Fractures (Geology), *Isotropy, On-site data collections, Theoretical analysis, Colorado, Geology, Hydrogeology, Mathematical models, Groundwater, Instrumentation, Sampling, Rocks.
Identifiers: *Rock apertures, *Groundwater exploration, Penetrants.

Accelerating demands for groundwater supplies have created an increased interest in the subject of fractured crystalline rock permeability. A mathematical model of intersecting plane conductors approaches real fracture geometry, affording insight into its permeability characteristics. The theory is used to compute the permeability of Pike's Peak Granite from observed orientations and measured apertures. A line sampling method was utilized in which a maximum number of fractures could be measured. The sampling line was oriented in the direction of central tendency of the normals to the fractures and it was assumed that fracture frequencies and orientations beyond the sampling line were identical to those along the sample. Sampling lines along outcroppings were established with surveyors tape at 59 sampling stations. A penetrant-photographic method was used for measurement of fracture apertures and its strengths and weaknesses are discussed. It was found that apertures were log normally distributed and the surface apertures were much larger than subsurface apertures but size predictability at various depths was impossible from the data. Until measurements can be made in depth in undisturbed rock, direct permeability computations cannot be made. However, an extensive mathematical method for estimating permeabilities from fracture orientations is described. (Casey-Arizona)
W71-00151

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1966-67,
Geological Survey, Washington, D.C.
Rita K. Llaverias.
Available from NTIS as PB-192 863, $3.00 in paper copy, $0.95 in microfiche. Geological Survey Interagency Report-189, May 1970. 127 p, 412 ref, 4 index.

Descriptors: *Bibliographies, *Remote sensing, *Information retrieval, *Water resources, Publications, Aerial photography, Agronomic crops, Forestry, Geomorphology, Geologic investigations, Glaciation, Hydrologic data, Meteorological data, Instrumentation, Methodology, Oceanography, Range management, Soil classifications, Urbanization, Satellites (Artificial).
Identifiers: *Earth resources data, Photographic techniques.

This is the second in a series of bibliographies on remote sensing of earth resources applications. The subject matter coverage is extended from the earlier more restricted area of hydrology to the broader field of earth resources, but the emphasis on water resources applications remains. Citations are given for 412 literature items appearing in 1966-1967, and represent such fields as agriculture, forestry, geography, geology, hydrology, meteorology, oceanology, range management, and urban planning. Indexes are provided for personal and corporate authors and subject. Each citation has three key word descriptors. (Lang-USGS)
W71-00173

EVALUATION OF INSTALLATION METHODS FOR NEUTRON-METER ACCESS TUBES,
Geological Survey, Idaho Falls, Idaho; and Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02G.
W71-00187

RANGE AND WILDLIFE HABITAT EVALUATION--A RESEARCH SYMPOSIUM,
For primary bibliographic entry see Field 06G.
W71-00209

TREND-SURFACE ANALYSIS OF GROUNDWATER FLUCTUATIONS,
Missouri Univ., Rolla.
For primary bibliographic entry see Field 02F.
W71-00259

INTEGRATING-FLOAT MEASUREMENTS AT LOW VELOCITIES,
Missouri Univ., Columbia; and Tennessee Valley Authority, Norris.
For primary bibliographic entry see Field 08B.
W71-00273

DEVELOPMENT OF A RESISTANCE-WIRE WAVE GAUGE FOR SHALLOW-WATER WAVE AND WATER-LEVEL INVESTIGATIONS,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Stanton G. Truxillo.
Louisiana State University Coastal Studies Institute Bulletin No 4, p 73-76, February 1970. 4 p, 3 fig, 2 ref. ONR Contract Nonr 1575 (03), NR 388 002.

Descriptors: *Water level fluctuations, *Gages, *Waves (Water), Electrical equipment, Conductivity, Instrumentation, Beaches, Tides, Surf, Surveys, On-site tests.
Identifiers: Wave gages.

A resistance-wire gage was developed for measuring water level fluctuations, including waves, in shallow waters. The stainless-steel wire is set in a spiral groove cut in 3/4 inch PVC pipe. Because the wire is protected in a groove in the PVC pipe, the staff is much more rugged and more safely portable than are the classical wave staffs where the wire is simply stretched between two insulating end posts. In addition, the spiral groove means that there is a large length of wire per unit length of staff, so the staff is electrically linear to within 1 percent after only 4 inches of staff is submerged. The high resistance per unit length produces a large output voltage with a small power supply, permitting use of the very simple and inexpensive oscillator and detector circuits shown. The circuit uses readily available parts and has the advantages of reliability, portability (with a 12-volt auto battery as power source), low current drain (less than 1 amp), and stability. (Knapp-USGS)
W71-00357

A NEW 'BASELESS' PROPORTIONAL WEIR,
Indian Inst. of Science, Bangalore (India). Dept. of Civil and Hydraulic Engineering.
N. S. Lakshmana Rao, and D. Chandrasekaran.

Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 341-355, 1970. 15 p, 6 fig, 3 plate, 2 tab, 7 ref.

Descriptors: *Discharge measurement, *Weirs, Discharge (Water), Water levels, Stage-discharge relations, Data collections, Water measurement, Flow measurement, Stream gages.
Identifiers: Proportional weirs.

The proposed new weir has some definite advantages over other types of weirs such as the exponential, logarithmic, sutro, quadratic, rectangular, triangular and parabolic weirs. Experimental verification of the head discharge relation is made for a typical weir and the coefficient of discharge is found to be 0.60. (Knapp-USGS)
W71-00359

REPEATABILITY OF THREE INSTRUMENTS USED TO DETERMINE THE UNDRAINED SHEAR STRENGTH OF EXTREMELY WEAK, SATURATED, COHESIVE SEDIMENTS,
Naval Oceanographic Office, Washington, D.C.
Joseph H. Kravitz.
Journal of Sedimentary Petrology, Vol 40, No 3, p 1026-1037, September 1970. 12 p, 6 fig, 3 tab, 30 ref.

Descriptors: *Test procedures, *Sediments, *Shear strength, *Instrumentation, Mechanical properties, Materials testing, Testing, Analytical techniques, Statistics, Quality control, Measurement.
Identifiers: Fall cone, Vane shear-testing, Torvane, Weak sediments.

Relative repeatability studies were made of the fall cone, motorized laboratory vane and torvane, when testing the undrained shear strength of extremely weak, saturated, cohesive sediments. The 26 sediment samples tested were collected from an artificial settling pond, tested for shear strength and analyzed for their chemical, mineralogical and physical properties. The fall cone showed the best repeatability with the motorized laboratory vane next and the torvane last. The individual repeatability of all three devices when testing extremely weak sediments is poor. Differences among the instruments were not significant at the 5 percent level. Instrument characteristics and testing methods rather than sediment characteristics are most likely responsible for differences among the instruments and for the low repeatability. None of the instruments are especially well suited for testing extremely weak sediments. Because of its greater repeatability the fall cone is preferred to the other two devices. (Knapp-USGS)
W71-00389

REMOTE SENSING FOR RESOURCE MANAGEMENT AND FLOOD PLAIN DELINEATION,
Wisconsin Univ., Madison. Dept. of Soil Science.
C. J. Milfred, D. E. Parker, and G. B. Lee.
Available from NTIS as PB-195 086, $3.00 in paper copy, $0.95 in microfiche. Reprint, Presented at the 24th Midwestern States Flood Control and Water Resources Conference, May 21-22, 1969, Milwaukee, Wisconsin. 17 p. OWRR B-002-WISC (11).

Descriptors: *Flood plain zoning, *Hydrologic data, *Soil surveys, *Aerial photography, Remote sensing, Radar.
Identifiers: Multiband photography, Infrared sensors, Multispectral sensors.

Remote sensing is becoming an extremely important research tool in modern resource management techniques. Water resource managers can use remote sensing systems to provide supplemental information in regions where planning has been hampered by the lack of suitable hydrologic data and other resource information. Continued pressure for encroachment and development on flood plains will generate a need for more comprehensive planning based on timely and accurate information about an entire river basin or watershed. With respect to flood plain delineation, remote sensors cannot be used to predict the height of future floods. They can provide information to indicate areas that have flooded which should help improve flood predictions based on theoretical models. Remote sensors offer a dynamic resource inventory system which can be used to complement traditional detailed studies and serve as an important source of information in regions where detailed studies are not available. Remote sensors generate a great deal of data and there is danger of accumulating more information than can be utilized. This problem can be largely overcome by maintaining a close working relationship between scientists working on applications of the sensors and resource managers who will use the information to help solve important natural resource problems.
W71-00415

SPATIAL SURVEILLANCE OF NATURAL RESOURCES,
Royal Aircraft Establishment, Farnborough (England).
D. I. Raitt.
Available from NTIS as N70-21145, $3.00 in paper copy, $0.95 in microfiche. Library Bibliography No. 308, January 1969. 23 p.
Identifiers: *Bibliographies, *Earth resources, *Satellite-borne photography, Aerial photography, Infrared photography, Remote sensors, Satellite observation, Surveillance.

This selective bibliography covers the period 1944 to date in general the coverage is of the following fields mineral deposits agriculture (vegetation, crops, soils), forestry (disease, fire), wildlife, livestock and water resources. A select list of references on applications satellites is also included.
W71-00452

MICROSCOPIC OPEN CHANNEL BOUNDARY LAYER VELOCITY MEASUREMENT USING A VERTUAL IMAGE METHOD,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 08B.
W71-00470

7C. Evaluation, Processing and Publication

FREQUENCY OF DESIGN DROUGHT,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 04A.
W71-00025

GEOLOGIC MAP OF THE LOWER CACHE LA POUDRE RIVER BASIN, NORTH-CENTRAL COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00049

SEDIMENT YIELDS OF WISCONSIN STREAMS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W71-00050

THE USE OF ANALOG AND DIGITAL COMPUTERS IN HYDROLOGY.
International Association of Scientific Hydrology, Gentbrugge (Belgium); and United Nations Educational, Scientific and Cultural Organization, Louvain (Belgium).
For primary bibliographic entry see Field 06A.
W71-00071

A STATISTICAL ANALYSIS OF THE RAINFALL OVER THE SUDAN,
Khartoum Univ. (Sudan). Dept. of Geography.
For primary bibliographic entry see Field 02B.
W71-00159

LINEAR PROGRAMMING MODEL FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque. Dept. of Economics.
For primary bibliographic entry see Field 06D.
W71-00165

RECONNAISSANCE BATHYMETRY OF PYRAMID LAKE, WASHOE COUNTY, NEVADA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02H.
W71-00189

BRIEF DESCRIPTIONS OF AND EXAMPLES OF OUTPUT FROM COMPUTER PROGRAMS DEVELOPED FOR USE WITH WATER DATA IN KANSAS,
Geological Survey, Lawrence, Kans.
Brent H. Lowell, Charles O. Morgan, and Jesse M. McNellis.
Kansas Geological Survey Special Distribution Publication 48, 1970. 54 p, 41 fig, 17 ref, append.

Descriptors: *Computer programs, *Data processing, *Hydrogeology, *Kansas, Hydrologic data, Water level fluctuations, Streamflow, Regression analysis, Mapping, Suspended load, Bed load, Sediment transport, Statistics, Statistical methods, Hydraulics, Channel morphology.
Identifiers: Water data computation.

Programs written in FORTRAN IV language were developed in the Kansas District of the U.S. Geological Survey to handle basic water data by use of the digital computer. The programs check, tabulate, graph, map, and statistically analyze data derived from hydrologic and geologic investigations. This report contains brief descriptions of and output from some of the digital computer programs. It is not meant to give detailed program information, but rather to acquaint the reader briefly with many of the programs that are currently available in Kansas for use with water data. All programs are written in FORTRAN IV programming language and are operational on the GE 635 computer at The University of Kansas Computation Center. The described programs can be used, with minor adaptations, on any computer with a FORTRAN IV compiler. Operational programs are separated into three general groups; checking and tabulation programs, standard analysis programs, and other programs. Additional programs that are in the development stage include: a program for performing a multitude of operations on water-level records including change maps for selected periods and regression analysis, a program for plotting graphically the suspended- and bed-load sediment data, and a program to treat statistically the parameters considered in hydraulic geometry of channels. (Knapp-USGS)
W71-00193

A COMPUTER METHOD FOR PUMPING-TEST ANALYSIS,
New Mexico Tech., Socorro. Research and Development Div.
For primary bibliographic entry see Field 02F.
W71-00197

GEOLOGY AND WATER RESOURCES OF CAMPBELL COUNTY, SOUTH DAKOTA; PART III-BASIC DATA,
South Dakota State Geological Survey, Vermillion, and Geological Survey, Vermillion, S. Dak.
For primary bibliographic entry see Field 02F.
W71-00210

T-WAVE, A COMPUTER CODE FOR ANALYZING THE NONSTEADY GRAVITY DECAY OF A GROUNDWATER ANOMALY,
California Univ., Livermore. Lawrence Radiation Lab.
John A. Korver.
Available from NTIS, as TID 4500, UC 35, price $3.00 paper copy, $0.95 microfiche. California University, Lawrence Radiation Laboratory UCRL-50830, March 16, 1970. 59 p, 3 fig, 2 ref, 5 append.

Descriptors: *Computer programs, *Mathematical models, *Water levels, *Groundwater movement, Water level fluctuations, Infiltration, Tracers, Permeability, Porosity, Hydrogeology.
Identifiers: T-Wave, Groundwater mounds.

The T-WAVE code is based on a one-dimensional numerical model describing the gravity decay of a groundwater mound. The Fortran program for the T-WAVE Code may be used to examine the time-dependent flow characteristics of anomalous groundwater mounds resulting from underground nuclear explosions near or below the regional water table. The code allows the permeability and porosity to be in either a cylindrical or spherical geometry surrounding the shot point, and it also allows for internal horizontal or vertical discontinuities of the permeability or porosity. It also possible to follow the horizontal displacement of ideally tagged water particles as a function of time. (Knapp-USGS)
W71-00211

OCEANS IV: A PROCESSING, ARCHIVING AND RETRIEVAL SYSTEM FOR OCEANOGRAPHIC STATION DATA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
M. E. Sweers.
Canada Department of Energy, Mines and Resources, Marine Sciences Branch Manuscript Report Series No 15, 1970. 137 p, 62 fig, 15 tab, 22 ref.

Descriptors: *Data storage and retrieval, *Computer programs, *Oceanography, Marine geology, Oceans, Data collections, Hydrologic data, Data processing, Information retrieval, Networks, Stations, Meteorological data, Gravity, Geophysics, Water temperature.
Identifiers: Oceanographic data.

OCEANS IV is a powerful system of programs used by the Canadian Oceanographic Data Centre to manage its oceanographic station data file. This file, at present, contains 30,000 stations consisting of, on the average, 10 observed levels each. The data are stored in geographical order on magnetic tape. The system can accept up to 35 different physical and chemical parameters in a partically open ended format. To date only 16 parameters have been assigned codes. The four basic functions of the OCEANS IV system are: (1) processing of reversing thermometer readings; (2) preparing temperature, salinity and chemical data for archival in the oceanographic station data file; (3) printing data reports on request; and (4) providing flexible retrieval of data from the file. (Knapp-USGS)
W71-00352

AUTOMATIC DEVICE FOR PLOTTING PROFILES OF HYDRAULIC MODELS,
Alberta Univ., Edmonton. Dept. of Electrical Engineering.
V. J. Kingma.
Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 329-339, 1970. 11 p, 7 fig, 1 ref.

Descriptors: *Hydraulic models, *Instrumentation, Sediment transport, *Profiles, *Channel morphology, Data collections, Light, Water levels, Sedimentary structures, Dunes, Ripple marks, Alluvial channels, Measurement.
Identifiers: Optical water-level measurement.

An optical probe is used as the sensor of an automatic hydraulic model contour follower. The sensor consists of a light source, a split lightpipe, and a photodiode. With an electromechanical servo system the probe is kept at a fixed, small distance from the contour to be measured. As the servo driven probe assembly is moved across the mode, output signals proportional to the horizontal and vertical displacements are fed into an X-Y plotter, thus producing a profile of the model. The accuracy is better than 0.8 mm. (Knapp-USGS)
W71-00360

MRIS BULLETIN-DEVELOPMENT ISSUE.
National Academy of Sciences-National Research Council, Washington, D.C. Maritime Research Information Service.
For primary bibliographic entry see Field 10.
W71-00395

ENGINEERING INVESTIGATION OF SEWER OVERFLOW PROBLEM - ROANOKE, VIRGINIA,
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
For primary bibliographic entry see Field 05G.
W71-00478

08. ENGINEERING WORKS

8A. Structures

ICE PRESSURE ON ENGINEERING STRUCTURES,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-00012

CHEMICAL CONTROL OF TREE ROOTS IN SEWER LINES,
Connecticut Argicultural Experiment Station, Storrs; California Univ., Davis; and California State Dept. of Public Works, Sacramento.
For primary bibliographic entry see Field 05D.
W71-00137

ON THE DESIGN AND CONSTRUCTION OF INFILTRATION GALLERIES,
Truman W. Bennett.
Groundwater, Vol 8, No 3, p 16-24, May-June 1970. 9 p, 1 fig, 8 ref.

Descriptors: *Galleries, *Infiltration, Drainage, Drains, Water yield, Drainage engineering, Recharge, Drawdown, Aquifer characteristics, Well screens, Pipes, Filters, Design, Construction, Sumps, Wells, Operation and maintenance, Subsurface drains, Subsurface drainage.
Identifiers: Drain filters, Pumping tests, Infiltration rate, Filter criteria, Construction methods.

Present knowledge regarding factors controlling yield and maintenance requirements of infiltration galleries permits a more accurate evaluation than is generally employed. Pump test procedures and the analysis necessary for a reliable prediction of the yield of infiltration galleries are outlined. Gallery design, including pipe size, pipe materials, slot size, filter materials, and sump size, is discussed. Gallery construction by installing permeable conduit in an open excavation and backfilling and by pipe projection from a central caisson are discussed. Rules for successful operation and maintenance procedures for the most prevalent difficulties occurring in gallery installations are suggested. (USBR)
W71-00258

DESIGN OF CARTERS PUMPED STORAGE PROJECT,
Army Engineer District, Mobile, Ala.
Walter W. Burdin.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No P03, p 383-400, June 1970. 18 p, 9 fig, 1 tab, 12 ref, append.

Descriptors: *Multiple-purpose projects, Recreation, Geology, Design, *Electric power production, Flood control, Rockfill dams, Construction, Reservoirs, *Pumped storage, Penstocks, Hydraulic turbines, Costs, Pump turbines, Georgia, Spillways, Hydroelectric plants, Earth dams.
Identifiers: *Carters Project (Ga).

The Carters Project is under construction on the Coosawattee River about 75 mi north of Atlanta, Ga. When completed in 1974, the project will consist of a 440-ft-high, rockfill main dam with a powerhouse on the right bank, an emergency spillway on the left bank, and a low, earth and rockfill reregulation dam about 2 mi downstream of the main dam. The powerhouse, of conventional enclosed design, will contain 4 units. Nominal generator rating for each of the 4 units is 125,000 kw. The 2 conventional Francis turbines are rated at 172,000 hp at 345 ft net head and 163.6 rpm. The 2 pump-turbines are rated as turbines at 173,000 hp at 345 ft net head and as pumps at 4,435 cfs at 347 ft total head, both at 150 rpm. Normal operating head at maximum power pool elevation 1072.0 will be about 385 ft. The multipurpose project is being developed for flood control, recreation, and power. The geology, hydrology, and design of the project are discussed. (USBR)
W71-00270

EFFECT OF SAFETY FACTOR AND CONCRETE STRENGTH ON COST OF ARCH DAMS,
Harza Engineering Co., Chicago, Ill.
Roman P. Wengler.
Paper, Conference on Rapid Constr of Concrete Dams, Pacific Grove, Calif, Mar 1970. 9 p, 3 tab.

Descriptors: *Arch dams, *Safety factors, *Dam design, *Costs, Stress, Safety, Dam construction, Yield point, Volume, Formwork (Construction), Cooling, Cost comparisons, Hydrostatics, Temperature, Loads (Forces), Stability, Concrete dams, Dams.
Identifiers: Concrete properties, Design strength, Ultimate strength, Cooling systems, Cost savings.

A study made to determine the effect on cost of arch dams for various safety factors concluded that if the safety factor is to be reduced, keeping the concrete strength constant and reducing concrete volume are definitely more advantageous than keeping the concrete volume constant and reducing strength. If the concrete strength is kept constant and volume is reduced, a savings of 12% is achieved by reducing the safety factor from 4 to 3 and 22% by reducing it from 4 to 2. The effect on cost of increasing the concrete strength while keeping the safety factor constant was small. The question arises as to whether or not a safety of 4 at one yr as traditionally defined is really necessary. This is a complex question involving a multitude of intangibles. Safety factors are used to build in provisions for all underlying uncertainties. The safety factor probably could be decreased as the uncertainties decreased because of improvement in design and construction techniques and improvement of instrumentation measurement techniques for studying prototype behavior of dams. While this alone may not be adequate justification for reducing safety factors, the question seems to warrant further discussion. (USBR)
W71-00272

SMALL WELLS MANUAL--A MANUAL OF LOCATION, DESIGN, CONSTRUCTION, USE AND MAINTENANCE,
Minnesota Univ., Minneapolis. Div. of Environmental Health.
Ulric P. Gibson, and Rexford D. Singer.
Department of State Agency for International Development (AID) Manual, 2nd Printing, Sep-

tember 1969. 156 p, 108 fig, 3 tab, 23 ref, 2 append.

Descriptors: *Water wells, *Drilling, *Water resources development, Pumps, Pumping, Rotary drilling, Well screens, Well casings, Well filters, Water quality, Water yield, Water supply, Water pollution control.
Identifiers: Small wells manual, Well design, Well construction.

This manual is intended to serve as a basic introductory text book and to provide instruction and guidance to field personnel engaged in the construction, operation and maintenance of small diameter, relatively shallow wells used primarily for individual and small community water supplies, particularly in developing parts of the world. It is aimed particularly at those persons who have had little or no experience in the subject. An attempt has been made to treat the subject matter as simply as possible in order that this manual may be of benefit not only to the engineer or other technically trained individual (inexperienced in this field) but also the individual home owner, farmer or non-technically trained community development officer. This manual should also prove useful in the training of water well drillers, providing the complementary background material for their field experience. (Knapp-USGS)
W71-00305

BURIED ASPHALT MEMBRANE CANAL LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 04A.
W71-00433

HAZARDS TO PEOPLE AND ANIMALS FROM BUREAU-CONSTRUCTED CANALS, OPEN AND CLOSED CONDUIT SYSTEMS PROGRAM,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Howard Latham, and James M. Verzuh.
Available from NTIS as PB-190 005, $3.00 in paper copy, $0.95 in microfiche. January 1970. 48 p. REC-OCE-70-2.
Identifiers: *Inland waterways, Hazards, Safety, Animals, Drowning, Water supplies, Humans, Irrigation systems, Economics, Construction.

Approximately 30 people drown in Bureau-constructed canals annually. An undetermined number of animals (mostly deer) also drown in these canals. Losses could be eliminated at considerable expense by covering existing canals or by placing them in buried conduits. Human and animal losses can be reduced at moderate expense by constructing adequate fencing. A survey of human drownings and a review of safety practices and policies are presented. Data relating to animal losses are provided. Unit costs of placing canals in buried conduits, covering canals and fencing canals are illustrated. Other suggested safety solutions, such as using stepped or corrugated canals linings and allowing canals and rights of way to be used for recreational purposes are examined. Recommendations for reducing drownings are given.
W71-00437

INVESTIGATION OF SOIL-STRUCTURE INTERACTION: FLEXIBLE CULVERT PIPES,
Ohio State Univ., Columbus. Engineering Experiment Station.
T. H. Wu.
Available from NTIS as PB-193 112, $3.00 in paper copy, $0.95 in microfiche. Interium Report EES-279-2. September 1969. 120 p.
Identifiers: *Roads, Sands, *Structures, Drainage, Interactions, Shear stresses, Pipes, Deflection, Compressive properties, Strain (Mechanics), Flexible structures, Mathematical models, Ohio, *Culverts, Soil stabilization.

Triaxial and 'trapdoor' tests were conducted on a sand to determine its stress-strain properties. Results of tests by Waterways Experiment Station and others are included in the report. Measured stresses compared closely to computed stresses. Computed deflections were many times greater than measured deflections for an undetermined reason. The report includes a print out of a finite element computer program developed by Brown of California and modified by the researchers to take into account nonlinear soil properties. Using the program, preliminary calculations were made for one set of conditions to illustrate the nature of results obtainable.
W71-00441

THERMAL ANALYSIS OF ABOVE-GROUND LIQUID DISTRIBUTION SYSTEMS (UTILIDORS) FOR POLAR APPLICATION,
Naval Civil Engineering Lab., Port Hueneme, Calif.
C. K. Smith.
Available from NTIS as AD-707 695, $3.00 in paper copy, $0.95 in microfiche. Technical Note N-1090, May, 1970. 34 p.
Identifiers: *Polar regions, Pipes, *Pipes, Thermal insulation, *Thermal insulation, Thermal analysis, Freezing, Structural shells, Configuration, Heat transfer, Mathematical models, Numerical analysis, Computer logic, Computer programs, Utilidors, Computer analysis.

In polar regions, service distribution pipes for water, sewage, and heating present special problems becuase they cannot be buried in the normal manner. One solution to this problem is to install an above-ground utilidor, which consists of a thermally insulated box-like structure through which the service lines run. One or more of the service lines provides the source of heat necessary to avoid freezing of all the other lines. A basic proolem in utilidor design is that the system must provide sufficient thermal protection to avoid freezing during coldest weather, but the temperatures of the liquids being distributed must not become undersirably high during warm weather. Therefore, thermal performance must be analyzed at both extremes of ambient and operating conditions before the utilidor design for a particular site is finalized. The document presents a general analysis and resulting computer program suitable for prediction of the thermal performance of various multi-pipe utilidor designs over a wide range of boundary conditions. The computed results are shown to compare favorably with experimental data for a particular design. The computer program is described, and sample calculations are presented.
W71-00465

FIELD AND LABORATORY TESTS FOR SAFETY OF DAMS INVESTIGATION AT SALT RIVER PROJECT, ARIZONA,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08F.
W71-00466

STANDARD UTILITY LOCATIONS FOR THE CITY OF PHOENIX.
Standard Utility Locations Committee, Phoenix, Ariz.

June 1970. 17 p, 20 fig.

Descriptors: *Utilities, *Urbanization, *Locating, *Municipal water, *Municipal wastes, *Sewers, *Right-of-way, *Road design, *Water conveyance, *Public utilities, *Distribution systems, Irrigation systems, Trenches, Conduits, Pipes, Design standards, Cross-sections.
Identifiers: *Utility locations, *Utility standards, *Standard utility locations, Phoenix.

Standards are described that will serve as guidelines for the installation and relocation of all utility services within public rights-of-way in the City of Phoenix. Very few municipalities in the United States have adopted comprehensive utility location standards and fewer have been published. Because of urban growth and added demands for public services such as potable water, irrigation water, sewerage, power, communication, heating fuel and others, more efficient use must be made of underground and aboveground space in public rights-of-way. It is also desirable to locate utility services so that street cuts and traffic interference are minimized. The report specifies the required location of utility conduits, pipes, cables, or poles in typical street types by means of cross-sectional sketches. The standards require a minimum thirty inches of cover over all underground utilities located in paved areas of streets, except for irrigation water pipe which must have eighteen inches. Domestic water lines, and sanitary and storm sewers are always placed in the street area along major and collector routes, whereas irrigation water lines are located in the sidewalk area. Along local streets, domestic water lines are located beyond the sidewalk, adjacent to property lines; however, sewers are within the street area. Sanitary sewers are also permitted in alleys and on easements. (Poertner)
W71-00484

JOHNSON V UNITED STATES (FLOODING CAUSED BY INCREASING DAM HEIGHT).
For primary bibliographic entry see Field 06E.
W71-00499

8B. Hydraulics

TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.
For primary bibliographic entry see Field 10.
W71-00015

SEDIMENT SAMPLING EFFICIENCY OF SLOTS,
Iowa Univ., Iowa City; and Technion - Israel Inst. of Technology, Haifa.
For primary bibliographic entry see Field 02J.
W71-00016

EXPERIMENTAL INVESTIGATION OF FORM OF BED-ROUGHNESS,
Southeastern Massachusetts Univ., North Dartmouth, Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-00018

WATER WAVE PRESSURE ON HORIZONTAL PLATE,
Delaware Univ., Newark. Dept. of Civil Engineering.
Hsiang Wang.
Work supported by DASA. ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7629, p 1997-2017, October 1970. 21 p, 14 fig, 1 tab, 16 ref, append.

Descriptors: *Waves (Water), *Uplift pressure, *Shore protection, Standing waves, Hydraulics, Energy, Surges, Erosion, Erosion control, Pressure.
Identifiers: Water wave pressure.

Simple rules are developed to estimate the maximum uplift pressures induced on the underside of a flat plate by various types of incident waves. Theoretical prediction techniques are provided for both the slow-rise pressure component and the fast-rise pressure component (impact) for different incident waves: standing waves, regular progressive waves, and dispersive waves, all in constant water depth. Laboratory experiments were conducted in a dispersive wave basin partially to check the validity of prediction techniques and partially to provide additional information so that the prediction techniques can be extended empirically to cover the more complicated but more practical

situation of a plate in shoaling water. The fast-rise pressure should be of engineering concern not only because the magnitude of its peak is enormous but also because the magnitude of the corresponding impulse is significant. The slow-rise pressure component was found to range from one to two times the hydrostatic pressure. (Knapp-USGS)
W71-00019

PREDICTING CONCENTRATION PROFILES IN OPEN CHANNELS,
Geological Survey, Fort Collins, Colo.; and Iowa Univ., Iowa City. Inst. of Hydraulic Research.
Harvey E. Jobson, and William W. Sayre.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7618, p 1983-1996, October 1970. 14 p, 8 fig, 1 tab, 12 ref, append.

Descriptors: *Sediment transport, *Turbulent flow, *Open channel flow, *Dispersion, Diffusion, Mass transfer, Turbulence, Sedimentation, Path of pollutants, Settling velocity, Model studies, Flumes, Hydraulic models, Mathematical models, Mixing, Computer programs.
Identifiers: Waste dispersion.

A steady state two-dimensional conservation of mass equation is solved numerically in order to describe the process of vertical mass transfer for both neutrally buoyant liquid and suspended sediment particles in an open channel flow. The relevancy of the equation is illustrated by comparing its solution with laboratory data obtained from experiments conducted in a large flume. The solution is then used to graphically illustrate the effects of various hydraulicparameters on mass transfer. Parameters investigated include the velocity distribution, the magnitude and distribution of the turbulent mass transfer coefficient, the particle fall velocity and the boundary conditions at the channel bed. The solutions indicate that the fall velocity controls the rate of descent of the dispersant mass but has little effect on the rate of spread of the dispersant. Conversely, the transfer coefficient controls the rate of spread of the dispersant but has little effect on its rate of descent. The most striking conclusion drawn from this study is that the dispersant distribution is not very sensitive to the distribution of the turbulent mass transfer coefficient. (Knapp-USGS)
W71-00020

VIRTUAL MASS OF PLATES AND DISCS IN WATER,
Frederic T. Mavis.
ASCE Proceedings, Journal of the Hydraulic Division, Vol 96, No HY 10, Paper 7593, p 1947-1952, October 1970. 6 p, 4 fig, 4 ref, append.

Descriptors: *Settling velocity, *Particle shape, Hydraulics, Laboratory tests, Viscosity, Instrumentation, Photography.
Identifiers: Virtual mass.

A method of studying virtual mass of plates and discs in linear-accelerated motion involves: (1) simple apparatus for strobophotographic recording of small displacements at the rate of 500 per sec within a test interval of 1/25 sec under the same initial force; and (2) analysis of data from wet and dry tests plotted on a trilinear chart with displacement as ordinate, mass as abscissa, and time intervals as parameter. Variability of data is reported. (Knapp-USGS)
W71-00022

UNSTEADY FLOW IN CHANNEL OF VARIABLE CROSS SECTION,
University of Strathclyde, Glasgow (Scotland).
For primary bibliographic entry see Field 02L.
W71-00023

WAVE-HEIGHT PREDICTION FOR WAVE GENERATORS IN SHALLOW WATER,
Army Coastal Engineering Research Center, Washington, D.C.
Cyril J. Galvin, Jr.
Available from NTIS as AD-440 880, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No. 4, Mar. 1964. 21 p.

Descriptors: *Beach erosion, *Shallow water, *Hydro dynamics.
Identifiers: *Wave-height, Wave generators, *Wave tanks.

The height of wave generated by displacement type wave generators in shallow water is approximately equal to 2piS/L times an appropriate dimension of the wave generator. S is the stroke of the wave generator, L is the wave length given by the small-amplitude theory, and the wave generator dimension is measured perpendicular to S. This relation agrees with the hydrodynamic theory for piston and flap-type wave generators over the range of relative depths usually used in coastal engineering experiments, and it agrees with data from four piston-type and two flunger-type wavegenerators for depths satisfying the condition (2piD/L) less than 1. This method of wave-height prediction can shorten the time spent on many coastal engineering experiments.
W71-00143

MODEL TESTS FOR A HORIZONTAL WELL,
For primary bibliographic entry see Field 02F.
W71-00198

CONSTRUCTION RECOMMENDATIONS, DESIGN CRITERIA AND THEIR APPLICATION,
Gabriel A. Echavez.
Transl from Spanish of Bur Reclam Transl 841, July 1970. 10 p, 3 fig, 2 tab. Nat Univ Mex, Inst Eng, No 226, p 151-161, Aug 1969.

Descriptors: *Cavitation, Erosion, *Spillways, Aeration, Construction, *Tunnels, *Design criteria, Roughness (Hydraulic), Fluid flow, *Pressure head, Vaporization, Velocity, Foreign research, Alinements, Finishing, Fluid mechanics, Mexico.
Identifiers: Cavitation control, *Cavitation index, *Recommendations, High velocity, Infiernillo Dam (Mex).

Erosion from cavitation in a high-velocity conduit such as a spillway tunnel is the primary factor to consider in construction; proper alinement and finishing are important. In addition, studying the possible use of aerating devices is advisable. A formula using roughness, pressure head, vaporization head, and bottom velocity is given for computing the coefficient of cavitation. An analysis of the spillway tunnels of the El Infiernillo Dam, Mexico, shows that the coefficient of cavitation decreases as the water velocity increases. When a bend is reached, the cavitation index increases because of an increase in pressure on the floor. The minimum value is found at the end of the bend; below the bend the cavitation index increases slowly because of a reduction in velocity close to the tunnel wall. The situation is more critical on the sidewalls than on the bottom because the depth is negligible on the bottom, provided there are no disalinements or isolated obstacles. (USBR)
W71-00264

INTEGRATING-FLOAT MEASUREMENTS AT LOW VELOCITIES,
Missouri Univ., Columbia; and Tennessee Valley Authority, Norris.
Henry Liu, and Larry D. Martin.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 96, No HY1, p 143-151, Jan 1970. 9 p, 1 fig, 1 tab, 7 ref, 2 append.

Descriptors: Hydraulics, Hydrology, *Open channel flow, *Floats, Flow, *Flow measurement, Instrumentation, *Stream gages, Streamflow, Fluid flow, Velocity, Laboratory tests, *Discharge measurement, Discharge (Water).
Identifiers: *Integrating-float method.

Accurate flow measurement by the integration-float method is possible if the method is used properly. Flow measurement by this method was tested in a rectangular flume 1 ft wide and 2 ft deep. Stainless steel hollow spheres, 5/8-in. dia were used as floats. Accuracy of the technique was evaluated by comparing discharges measured with floats to those measured with standard weirs. Despite the influence of flow nonuniformity on some measurements, the average error was only 2.4% for the range of velocities studied (0.02 fps to 0.3 fps); this error is much less than can be expected from conventional current meters at such low velocities. Because no apparent decrease in accuracy was observed for the lower range of velocities studied, the same accuracy can be expected at flows of even smaller velocities. The potential usefulness of the technique for streamflow measurement at low velocities should not be overlooked. (USBR)
W71-00273

ANALYSIS OF HYDRAULIC TESTS IN HOT CREEK VALLEY, NEVADA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-00306

HYDRAULIC TESTING OF WELLS IN CENTRAL NEVADA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-00307

ESTUARY ENTRANCE UMPQUA RIVER, OREGON--HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
G. M. Fisackerly.
Report available from NTIS, Springfield, Virginia. Corps of Engineers, Waterways Experiment Station Technical Report H-70-6, May 1970. 20 p, 2 fig, 177 plate, 83 photo, 3 tab.

Descriptors: *Hydraulic models, *Oregon, *Estuaries, *Channels, Navigation, River training, Erosion control, Sedimentation, Channel improvement, Inlets (Waterways), Jetties, Coastal structures, Harbors, Shore protection.
Identifiers: Umpqua River (Ore).

The Umpqua River estuary model of the fixed-bed type, was constructed to scales of 1:300 horizontally and 1:100 vertically, to reproduce the lower 28 miles of the Umpqua River, Oregon and an adjoining portion of the Pacific Ocean. The model was equipped for accurate reproduction and measurement of tides, tidal currents, waves, salinity intrusion, freshwater inflow, shoaling distribution, and other significant prototype phenomena. The purpose of the model study was to determine the optimum plan for the reduction of shoaling and elimination of cross-currents in the navigation channel at the entrance. The model hydraulic and salinity regimens were in satisfactory agreement with those of the prototype for comparable conditions; therefore the model provided quantitative answers concerning the effects of the proposed plans on the hydraulic and salinity regimens of the estuary. The optimum plan consisted of existing conditions plus a 2600-ft extension of the training jetty to the outer end of the south jetty. Results of model tests indicate that the optimum plan can eliminate cross-currents without aggravating the wave climate or shoaling conditions. (Knapp-USGS)
W71-00308

HYDRAULICS OF BRIDGE WATERWAYS.
Bureau of Public Roads, Washington, D.C. Bridge Div.

For sale by Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402--Price $1.25. Bureau of Public Roads

Hydraulic Design Series No 1, Federal Highway Administration, 2d edition 1970. Bradley, Joseph N., Consultant. 111 p, 55 fig, 11 tab, 43 ref, 3 append.

Descriptors: *Stage-discharge relations, *Backwater, *Flow profiles, *Bridges, Abutments, Hydraulics, Streamflow, Discharge (Water), Water levels, Water level fluctuations.
Identifiers: Backwater computation (Bridges).

Design charts and methods are presented for a wide variety of bridge backwater problems. The method of computing backwater as presented is intended to be used for relatively straight reaches of streams having subcritical flow and approximately uniform slope. The design information applies specifically to the normal stage-discharge condition. The method described permits a direct solution for backwater but requires a trial solution for discharge. (Knapp-USGS)
W71-00350

MODEL SIMILARITY CONCERNING THE TRANSPORT OF SUSPENDED MATTER IN A TURBULENT FLOW FIELD,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
Mutlu Sumer.
Also published in French. Journal of Hydraulic Research, Vol 8, No 3, p 357-364, 1970. 8 p, 1 fig, 6 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Sediment transport, Model studies, Hydraulics, Settling basins, Settling velocity, Sedimentation rates, Particle shape, Particle size, Turbulent flow, Suspended load.
Identifiers: Model similarity.

Model similarity in studies of the transport of suspended matter in a turbulent flow field is investigated and the most general conditions that establish the equivalence between prototype and model are obtained. The results are applied to settling basins. Models may be constructed without distortion in order to give equivalence between prototype and model. (Knapp-USGS)
W71-00358

AUTOMATIC DEVICE FOR PLOTTING PROFILES OF HYDRAULIC MODELS,
Alberta Univ., Edmonton. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 07C.
W71-00360

DIMENSIONAL ANALYSIS OF ALLUVIAL CHANNELS WITH SPECIAL REFERENCE TO MEANDER LENGTH,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 02J.
W71-00361

HYDRAULIC JUMP WITHIN A GRADUALLY EXPANDING CHANNEL,
Asian Inst. of Tech., Bangkok (Thailand).
Alejandro U. Abella.
M.Eng. Thesis No 276, Asian Institute of Technology, 1970. 62 p, 16 fig, 6 tab, 20 ref.

Descriptors: *Hydraulic jump, *Open channel flow, *Energy dissipation, Stilling basins, Energy losses, Mathematical models, Hydraulic models, Alluvial channels, Stream erosion, Scour, Turbulent flow, Transition flow, Critical flow, Supercritical flow.
Identifiers: Circular hydraulic jump, Expanding flow.

Hydraulic jump occurring was studied in the transition of a gradually expanding channel. This expanding channel jump is considered to behave as a section of a circular jump. Equations describing the characteristics of the expanding channel jump are derived from the three basic principles of fluid flow. Observations were conducted using six different angles of divergence. The experimental results showed a close agreement with the theoretical solutions. The general equation developed for the jump, with proper evaluation of the side pressure force effect, describes well the phenomenon regardless of the angle of divergence. Expanding channel jump is relatively better than the jump in a rectangular channel for energy dissipation. An empirical expression for approximating the location of the jump within the transition was also developed. (Knapp-USGS)
W71-00383

EFFECT OF RAINFALL ON THE VELOCITY DISTRIBUTION AND TRACTIVE FORCE IN A TRIANGULAR OPEN CHANNEL,
Mississippi State Univ., State College. Dept. of Agricultural and Biological Engineering; and Auburn Univ., Ala. Dept. of Agricultural Engineering.
E. Dale Threadgill, and Ronald E. Hermanson.
American Society of Agricultural Engineers Transactions, Vol 12, No 3, p 352-355, May-June, 1969. 4 p, 2 fig, 3 tab, 13 ref.

Descriptors: *Rainfall-runoff relationships, *Open channel flow, *Hydraulic models, Rainfall, Distribution, *Velocity, *Tractive forces, Model studies, Regression analysis, Temperature.
Identifiers: *Triangular open channel, Sensors.

The effect of rainfall on the velocity distribution and tractive forces in a shallow, triangular channel was determined in a research flume equipped with a rainfall simulator. All tests were conducted at each of three depths of flow, 2, 4, and 6 inches, measured at the centerline of the flume. Vertical velocity profiles were obtained at each of the flush-mounted sensors and at the centerline of the flume by taking point velocity readings with the cylindrical hot-film sensors. Readings of the point velocities and tractive forces were taken at each flow depth without rainfall and with each of the three rainfall intensities. All tests were made for flow over both the rough and the smooth boundary. The sensors were recalibrated if the temperature of the water or the cold resistance of the sensor changed. In general, rainfall did not have a significant effect on the velocity gradients for any rainfall intensity or flow depth. Analyses of the data are tabulated. (Woodard-USGS)
W71-00405

ENERGY DISSIPATION IN OPEN CHANNELS BY LARGE SEMI-CIRCULAR DISK ROUGHNESS ELEMENTS,
Asian Inst. of Tech., Bangkok (Thailand).
Eer-ruenn Charng.
M. Eng. Thesis No 232, Asian Institute of Technology, 1969. 66 p, 8 fig, 6 tab, 22 ref, append.

Descriptors: *Open channel flow, *Roughness (Hydraulic), *Hydraulic gradient, *Energy losses, Turbulent flow, Head loss, Flow resistance, Fluid friction, Flumes, Hydraulic models, Air entrainment, Manning equation, Froude number.
Identifiers: Steep channels.

Flume tests were conducted using semi-circular disks as roughness elements in steep channels. The disks were made of aluminum sheets. The relative depths investigated ranged from approximately 1 to 6. From the experimental results, no meaningful relationships could be found between the flow resistance, the relative depth and geometric parameters describing the channel shape. This indicated that other variables such as air entrainment and the Froude number of the flow, which were originally not considered to be significant, were important in describing the flow phenomenon. (Knapp-USGS)
W71-00406

DELAWARE RIVER MODEL STUDY, REPORT NO 1. HYDRAULIC AND SALINITY VERIFICATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Available from NTIS as AD-70 9741, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No. 2-337, May 1956. 113 p.
Identifiers: *Delaware Bay, Hydraulic models, *Estuaries, Salinity, Inland waterways, Tides, River currents, Water pollution, Wastes (Industrial), Wastes (Sanitary engineering), Drainage, Dams, Construction, Pennsylvania, Delaware, New Jersey, Rivers, *Delaware River, *Salinity intrusion, *Channel improvements, Salinity distribution, Fresh water discharge, Graphs (Charts).

The Delaware River model reproduces the entire estuarine portion of Delaware Bay and River from the Capes to Trenton, N.J. The model is of fixed-bed construction and is equipped with all necessary appurtenances for accurate reproduction and measurement of tides, tidal currents, salinity intrusion, channel shoaling, and other significant phenomena of the prototype. The principal problems to be studied on the model are concerned with reduction of shoaling and salinity intrusion, although other problems of a lesser degree of importance will also be investigated. This report is concerned with the hydraulic and salinity verification of the model, and contains complete data showing the degree of accuracy attained with respect to duplication in the model of observed portotype phenomena.
W71-00443

AN EXPERIMENTAL STUDY OF TURBULENT DIFFUSION OF DRAG-REDUCING POLYMER ADDITIVES,
LTV Research Center, Dallas, Tex.
R. R. Walter, and C. S. Wells.
Available from NTIS as AD-709 455, $3.00 in paper copy, $0.95 in microfiche. April 1970. 38 p. ONR 062-422.
Identifiers: *Diffusion, *Additives, *Drag, Reduction, *Polymers, Skin friction, Turbulence, Injection, Pipes, Fluid flow, Thickness, Concentration (Chemistry), *Drag reducing fluids, Pipe flow.

An experimental study of the mechanics of turbulent diffusion when uniformly injecting a drag-reducing polymer solution through a wall adjacent to a fully developed pipe flow of water is described. Experimental diffusion data were obtained using very low injection rates in a porous wall pipe tos section designed on the basis of a prior theoretical diffusion analysis with uniform injection. The drag-reducing effectiveness of the polymer only in the wall region, discovered previously, is substantiated by detailed concentration profile, velocity profile and wall shear stress data. These data indicate that an increase in the viscous sublayer thickness is accompanied by an increase in the diffusion sublayer thickness for uniform drag-reducing polymer injection. Also, uniform polymer injection at the wall appeared to somewhat inhibit the turbulent diffusion away from the wall. This type of injection provided drag reduction with a much smaller supply of polymer than required to raise the concentration throughout the shear layer to the same drag-reducing level.
W71-00469

MICROSCOPIC OPEN CHANNEL BOUNDARY LAYER VELOCITY MEASUREMENT USING A VERTUAL IMAGE METHOD,
Illinois Univ., Urbana. Water Resources Center.
Harry G. Wenzel, and Kuo C. Chang.
Available from NTIS as PB-195 163, $3.00 in paper copy, $0.95 in microfiche. Illinois Water Resources Center Research Report 31, April 1970. 31 p, 1 tab, 11 fig, 12 ref. OWRR Project A-026-ILL (1).

Descriptors: *Boundary layers, *Microscopy, *Open channel flow, *Tracers, Tractive forces, Velocity, Flow.

dentifiers: *Velocity measurement, Virtual image nethod.

A method for velocity measurement is described vhich employs a microscope and high speed mo- ion picture camera to record the motion of small racer particles suspended in the flow. The rocedure, termed the image method, involves par- icle illumination such that the particle itself and its irtual image created by reflection from a bounda- y both appear on the film. The boundary is then ocated equidistant from the two images. The plane f focus is oriented normal to the boundary giving a icture of the entire velocity profile normal to the oundary within the limits of the field of view. A rame by frame analysis of the particle motion can ield velocity profile and turbulence information. The image method was adapted to a small open hannel. Considerable difficulty was encountered n illuminating the particles with sufficient intensity o impress their image on the film. Thus, quantita- ive data was not obtained. It was concluded that he lens system used to focus the light source was nadequate. However, the method has potential ap- lications in velocity measurement near a bounda- y and flow visualization studies.
V71-00470

HYDRAULIC GEOMETRY OF 12 SELECTED STREAM SYSTEMS OF THE UNITED STATES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02E.
W71-00472

8D. Soil Mechanics

LOAD TRANSFER IN EARTH AND ROCKFILL DAMS,
Shannon and Wilson, Inc., Portland, Oreg.
L. Radley Squier.
Proceedings American Society of Civil Engineers, Soil Mechanics Foundation Division, Vol 96, No SM1, p 213-233, Jan 1970. 21 p, 20 fig, 4 tab, 23 ref, append.

Descriptors: Dams, *Earth dams, *Rockfill dams, nstrumentation, Loads (Forces), *Load distribu- ion, Stress concentration, Stress distribution, *Dif- erential settlement, Structural behavior, Soil nechanics, Cracking, Earth pressure, Compressi- ility, Differential displacements, Settlement Structural), Strain, Pore pressure, Stress, Bibliographies.
dentifiers: Stress reversal, Arching, Netzahual- coyotl Dam, Mexico, El Infiernillo Dam, Mexico, Arch action, Embankment subsidence.

nstrumentation data obtained from several major ockfill dams revealed that various modes of load ransfer and changes in modes may occur in an em- bankment. Load transfer may influence signifi- cantly the characteristics of embankment behavior, ettlements and cross-valley displacements, strains, pore-water pressures, and earth pressures. Effects of load transfer on embankment behavior are a unction of the stiffness of the core materials in conjunction with the settlement characteristics of he shell materials. Occurrence and effects of load ransfer in Mexico's El Infiernillo and Netzahual- coyotl Dams are described. The instrumentation used in the study consisted of inclinometers and crossarms installed during construction of the em- bankments. Settlement data were expressed in erms of strains or in terms of a percentage of the surface increment of settlement. Changes in strain at depth within certain intervals of time reflected changes in stress. A need exists for greater use of nstrumentation of the type which, during construc- ion and post-construction periods, reflects the mass behavior of the various zones comprising the dam. (USBR)
W71-00257

INFLUENCE OF GRAIN ORIENTATION ON DIRECT SHEAR STRENGTH OF A LOESSIAL SOIL,
Rudolph V. Matalucci, Mohamed Abdel-Hady, and John W. Shelton.
Engineering Geology, Vol 4, No 2, p 121-132, Apr 1970. 12 p, 10 fig, 2 tab, 12 ref.

Descriptors: Soil engineering, Soil mechanics, Soil properties, *Shear strength, Soil strength, *Soil structure, Soil tests, Shear tests, Shear planes, Direct shear, Anisotropy, *Loess, Undisturbed samples, Effects.
Identifiers: Failure surfaces.

Direct shear tests were used to evaluate strength anisotropics of undisturbed specimens of Vicksburg loess caused by particle imbrication and azimuthal preferred grain orientation. Average peak shear strength of dry specimens sheared parallel to imbrication was 9% lower than those sheared perpendicular to imbrication. Average peak strength of dry specimens sheared parallel to preferred grain orientation was 12% lower than those sheared perpendicular to grain orientation. For moist specimens the same trend was maintained, but the degree of strength variation was considerably smaller. Failure planes parallel to grain orientation produced off-lapping, short, discontinuous fractures; failure planes normal to grain orientation produced uniform, continuous fractures. Azimuthal preferred grain orientation and particle imbrication were determined from measurements on photomicrographs and by using a dielectric anisotropy instrument. (USBR)
W71-00260

8E. Rock Mechanics and Geology

ICE PRESSURE ON ENGINEERING STRUCTURES,
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02C.
W71-00012

ROCK PROPERTIES AND STEEL TUNNEL LINERS,
California State Dept. of Water Resources, Sacramento.
George H. Kruse.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No P03, p 415-435, June 1970. 21 p, 11 fig, 2 tab, 16 ref, 2 append.

Descriptors: *Steel linings, *Tunnel design, *Tunnel linings, Tunnels, Pressure tunnels, Bibliographies, Liner plates, *Rock properties, Rocks, Water tunnels (Conveyance), Rock mechanics, Design, Stress distribution, Design criteria, Stress analysis, Classification, Deformation, Strain, Relaxation.
Identifiers: Tehachapi Discharge Lines (Calif), Design improvements, Rock pressures, In situ tests, Deformation modulus, Tunnel supports.

The economical design of steel liners for underground pressure tunnels in rock is dependent upon the determination of the properties of the rock envelope and its state of stress. For maximum economy, liner plate thickness is held to a minimum by relying on the load-bearing response of the rock to resist part of the internal hydrostatic pressure while restraining the steel liner at a safe level of strain. A method is presented for evaluating the load-bearing response of the rock around the tunnel, based upon measurement of tunnel convergence (relaxation) during excavation. A system is described for classifying rock along the tunnel and providing appropriate adjustments of linear thickness and reinforcement. A design analysis based on a criterion of steel strain is presented. (USBR)
W71-00269

INSTALLATION, PRESSURIZATION, AND GROUTING OF HYDRAULIC FLAT JACKS IN MORROW POINT POWERPLANT,
Bureau of Reclamation, Denver, Colo.
M. L. Haverland.
Bureau of Reclamation Report REC-OCE-70-19, June 1970. 48 p, 36 fig, 13 tab.

Descriptors: *Underground powerplants, Underground structures, *Rock mechanics, Rocks, Installation, Pressure, Grouting, Calibrations, *Earth movements, Testing, Movement, Piping (Mechanical), Instrumentation, Measurement, *Stabilization.
Identifiers: *Flat jack method, *Jacking, Morrow Point Powerplantcolo), Rock pressures, Underground openings.

Hydraulic flat jacks were installed at strategic locations in the underground excavation for Morrow Point Powerplant, Colo, to provide a reaction against moving rock in a shear zone. Structural behavior monitoring instruments indicated that one rock wall of the underground chamber, located in a shear zone, was slowly moving toward the river. Because construction of the concrete powerplant structure was scheduled for the near future, installing and pressurizing the flat jacks would fill the void caused by concrete shrinkage and provide a known amount of post-stress load. The interior walls and floors would act as load-bearing struts across the powerplant. Twenty flat jacks 96-in. by 16-in. were installed, tested and calibrated, instrumented, pressurized, and grouted. Rock movement stopped while this program was being accomplished, but other remedial measures were in progress at the same time. Which measures had the most effect or whether all worked together to stop the movement cannot be determined. Descriptions of the flat jack installation are included. (USBR)
W71-00274

8F. Concrete

CONCRETE BECKONS POLYMERS.

Chemical Engineering, Vol 77, No 5, p 70-72, Mar 1970. 2 p.

Descriptors: *Concrete technology, *Polymers, *Strength, *Durability, Epoxy resins, Styrenes, Concrete pipes, Impregnation, *Irradiation, Heat, Catalysts, Construction materials, Road construction, Adhesion, *Monomers, Tunnel linings, Costs, Research and development.
Identifiers: *Concrete-polymer materials, *Polymer concretes, Rupture modulus, Polymerization, Bond strength, Brookhaven National Lab.

When polymers are combined with concrete, the resulting composite offers high strength and durability. Polymer addition might even made structural materials of soil or garbage and sewage. The polymer contributes to such properties as strength, durability, and water resistance. A broad range of polymers and monomers are being studied, including methyl methacrylate, polyesters, styrene, epoxies, and nylon. Projects involving concrete are aimed mainly at improving strength. Steel-reinforced concrete panels treated with methyl methacrylate and polymerized increases the modulus of rupture 2-1/2 times. Similarly, pullout strength is increased by a factor of 3 for concrete reinforced with steel bars. Surface impregnation of concrete increases durability. Soil-polymers for building materials and polymers in tunnel walls are discussed. (USBR)
W71-00261

EFFECT OF SAFETY FACTOR AND CONCRETE STRENGTH ON COST OF ARCH DAMS,
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 08A.
W71-00272

FIELD AND LABORATORY TESTS FOR SAFETY OF DAMS INVESTIGATION AT SALT RIVER PROJECT, ARIZONA,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
W. G. Austin.
Available from NTIS as PB-191 775, $3.00 in paper copy, $0.95 in microfiche. REC-OCE-70-7, February 1970. 68 p.
Identifiers: *Dams, Safety, *Arizona, Dams, Test methods, Reinforced concrete, Stresses, Loading (Mechanics), Deformation, Construction materials, Drilling, Strain (Mechanics), Rivers, Drilling machines, Salt River Project, Coring.

Survey records indicated that Stewart Mountain and Horse Mesa Dams, San River Project, Ariz., had nonrecoverable displacements exceeding the elastic capability of concrete in order to assess the safety of these dams, the magnitudes of the internal stresses in the concrete under near maximum loading conditions were required. The internal strains were measured in situ by stress relief methods using a borehole deformation gage. A similar program also was conducted on Mormon Flat Dam. Several laboratory tests were performed on the 6-in. extracted cores to obtain physical properties. Laboratory preparations for the field tests, field stress relief tests, and laboratory core tests conducted for the Safety of Dams Program for the Salt River Project are reported.
W71-00466

8G. Materials

DYNAMIC YOUNG'S MODULUS AND FLEXURAL STRENGTH OF SEA ICE,
Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02C.
W71-00043

THE EFFECTS OF VELOCITY ON THE PASSIVATION OF ALLOYS IN BRACKISH WATER,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 03A.
W71-00064

EVALUATION OF A SINGLE LAYERED GRADED GRAVEL AS A PROTECTIVE FILTER,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 04D.
W71-00413

SEEDING OF BRACKISH WATER IN A SPRAY FILM EVAPORATOR,
Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 03A.
W71-00463

8H. Rapid Excavation

IDEAS FOR PEACEFUL NUCLEAR EXPLOSIONS IN USSR.

International Atomic Energy Agency Bulletin, Vol 12, No 2, p 11-21, 1970. 11 p, 2 fig.

Descriptors: *Nuclear explosions, *Underground explosions, Mining, Underground storage, *Canal construction, *Reservoir construction, Field tests, Safety, Research and development, Foreign research, Seismic properties, Radiation effects, Radioactive contamination, Inter-basin transfers, *Investigations, Construction, Costs, Permafrost.
Identifiers: *Nuclear excavation, USSR, Underground cavities, Gas production, Explosive excavation.

Possible applications of peaceful nuclear explosions in the Soviet economy are reviewed. Scientific research figures prominently in plans for future industrial application of nuclear explosions. Contained blasts and excavation blasts have been investigated. Much work has been done to define fields of application and projects in which nuclear explosions can be used for industrial purposes. Excavation blasts discussed include: reservoir construction, canal construction, and uncovering mineral deposits. Contained blasts discussed include: intensified exploitation of oil and gas deposits; experimental explosions in salt formations; creation of underground cavities for storing natural gas, gas condensates, and oil products; and underground working of ore deposits. (USBR)
W71-00271

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

PROCEEDINGS OF CONFERENCE ON ONGOING WATER RESOURCES RESEARCH IN MINNESOTA, MARCH, 1970.
Minnesota Univ., Minneapolis. Water Resources Research Center.

Available from NTIS as PB-194 783, $3.00 in paper copy, $0.95 in microfiche. Minnesota University Water Resources Research Center Bulletin 21, June 1970. 56 p.

Descriptors: *Water resources research act, *Minnesota, *Universities, Research and development, Training, Data collections, Contracts, Limnology, Water pollution control, Fisheries, Wildlife, Hydraulics, Sedimentation.

On Mar. 26, 1970, a Conference on Ongoing Water Resources Research in Minnesota was sponsored by the Minnesota Water Resources Research Center. The objective of the Conference was to acquaint those concerned with water resources in Minnesota with the nature of ongoing water resources research activities in the State. Representatives from 14 organizations having research programs participated in the Conference. Most of the papers presented at the Conference are published in this Bulletin. (Knapp-USGS)
W71-00163

BOOKS, PUBLICATIONS, PROJECT COMPLETION REPORTS, AND M.S. AND PH.D THESES.
Iowa State Water Resources Research Inst., Ames.

Available from NTIS as PB-195 082, $3.00 in paper copy, $0.95 in microfiche. Iowa State Water Resources Research Institute, Iowa State University, June 30, 1970. 68 p. OWRR Project No A-999-IA (2).

Descriptors: *Bibliographies, *Abstracts, *Water resources research act, *Iowa, Water resources, Universities, Research and development, Grants.
Identifiers: Iowa State University.

Books, publications, project completion reports and M. S. and Ph. D. theses related to research program activities supported under Office of Water Resources Research annual allotments and matching grants to the Iowa State Water Resources Research Institute are listed. Information abstracts are also included for most references. (Knapp-USGS)
W71-00344

9D. Grants, Contracts, and Research Act Allotments

REPORT OF THE UNITED STATES DELEGATION TO THE SIXTH SESSION OF THE COORDINATING COUNCIL OF THE INTERNATIONAL HYDROLOGICAL DECADE, UNESCO, GENEVA, SWITZERLAND, JULY 6-11, 1970.
For primary bibliographic entry see Field 06E.
W71-00048

PROCEEDINGS OF CONFERENCE ON ONGOING WATER RESOURCES RESEARCH IN MINNESOTA, MARCH, 1970.
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 09A.
W71-00163

10. SCIENTIFIC AND TECHNICAL INFORMATION

TRANSLATIONS OF FOREIGN LITERATURE ON HYDRAULICS.

ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY 10, Paper 7630, p 2079-2088, October 1970. 10 p, 148 ref.

Descriptors: *Translations, *Bibliographies, *Foreign research, *Hydraulics, Flood control, Fluid mechanics, Instrumentation, Documentation, Publications, Streamflow.
Identifiers: Hydraulics literature (Translations).

A bibliography of 148 references is presented of translations of foreign literature on hydraulics. The present list is the second issued since ASCE Manual 35 (1968). This list is an addendum to Manual 35 and is part of the planned revision of the Manual. (Knapp-USGS)
W71-00015

MERCURY BIBLIOGRAPHY,
Eastman Kodak Co., Rochester, N.Y. Kodak Park Div.
For primary bibliographic entry see Field 05A.
W71-00167

REMOTE SENSING BIBLIOGRAPHY FOR EARTH RESOURCES, 1966-67,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-00173

SELECTED BIBLIOGRAPHY-LOWER MEKONG BASIN.
United Nations Engineer Agency for Resource Inventories, New York.

July 15, 1969. 2 volumes (Vol I, 310 p; Vol II, 223 p).

Descriptors: *Bibliographies, *Water resources, *Resources, Land resources, Human resources, Geology, Geography, Economics, Agriculture, Climates, Fisheries, Education, Electric power, Soils, Mineralogy, Transportation, Forestry, Cities.
Identifiers: Mekong River Basin.

The Selected Bibliography-Lower Mekong Basin of over 3,000 references was prepared as a companion reference work for use with the Atlas of Physical, Economic and Social Resources of the Lower Mekong Basin which was published in September 1968. It is also offered as a research tool that may be used independently of the atlas. The 2 volumes were designed to accommodate change for long-range usefulness of their contents. The loose-leaf style provides the potential for a program of subject category expansion. In main the entries represent material available in the Washington, D. C. area. The file location of each item and additional information not included in the printed bibliography are available at the Engineer Agency for Resources Inventories (United Nations). Within each subject the entries are listed alphabetically by author with single authors preceding joint

or multiple authors, and with title used as main entry when there is no author. Titles by the same author are arranged alphabetically. Some compilations are entered under an editor or title if there are several authors. Entries are given in the language of the original with the exception of those in non-Roman alphabets which are translated or transliterated. (Knapp-USGS)
W71-00229

BOOKS, PUBLICATIONS, PROJECT COMPLETION REPORTS, AND M.S. AND PH.D THESES.
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 09A.
W71-00344

OCEANS IV: A PROCESSING, ARCHIVING AND RETRIEVAL SYSTEM FOR OCEANOGRAPHIC STATION DATA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
For primary bibliographic entry see Field 07C.
W71-00352

MRIS BULLETIN-DEVELOPMENT ISSUE.
National Academy of Sciences-National Research Council, Washington, D.C. Maritime Research Information Service.

National Academy Science, Maritime Research Information Service Bulletin, Summer 1970. 226 p. Maritime Administration Contract MA-4776.

Descriptors: *Bibliographies, *Abstracts, *Information retrieval, *Oceanography, Marine geology, Navigation, Water pollution control, Ships, Computers, Research and development, Transportation.

The Maritime Research Information Service (MRIS) is a system for acquisition, selection, storage, retrieval, and dissemination of references to proposed, ongoing, and completed research and development projects and to technical reports and journal articles in the maritime field. MRIS incorporates concepts and procedures that are compatible with data standards recommended by the Committee on Scientific and Technical Information (COSATI). The MRIS Bulletin is compiled and published from the computer tape records of the Maritime Research Information Service (MRIS). Each issue will contain only that information acquired since the previous issue, and an annual consolidated bulletin will be compiled containing all selections for the preceding year. Selections for this publication are made by the MRIS professional staff and include unclassified-unlimited contributions from the Maritime Administration, U. S. Department of Commerce; Science Information Exchange (SIE); Engineering Index (EI); National Technical Information Service (NTIS); Department of Defense (DOD); National Aeronautics and Space Administration (NASA); Atomic Energy Commission (AEC); Transportation Research Information Service of the National Academy of Sciences (TRIS); and Joint Publications Research Service (JPRS). Three indexes are provided, as follows: (1) Subject Term Index; (2) Author/Investigator Index; and (3) Publisher/Performing Organization Index. (Knapp-USGS)
W71-00395

SPATIAL SURVEILLANCE OF NATURAL RESOURCES,
Royal Aircraft Establishment, Farnborough (England).
For primary bibliographic entry see Field 07B.
W71-00452

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Illinois Water Resources center	W71-00470--00472	3
Mississippi Water Resources Research Institute	W71-00473	1
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Engineering Aspects of Urban Water Resources (Herbert G. Poertner)	W71-00483--00486	4
Office of Saline Water	W71-00481--00482	2

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWQA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Federal Water Quality Administration in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 2
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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
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VOLUME 4, NUMBER 2
JANUARY 15, 1971

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1954, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

STATISTICAL MODELS FOR SURFACE RENEWAL IN HEAT AND MASS TRANSFER, PARTS III. AND IV.,
Argonne National Lab., Ill.
L. B. Koppel, R. D. Patel, and J. T. Holmes.
AIChE Journal, 16 (1970), No 3, p 456-471; 5 fig, 2 tab, 15 ref.

Descriptors: *Interfaces, Boundary processes, *Heat transfer, *Mass transfer, Boundaries, *Statistical models, Frequency analysis, Systems analysis, Surfaces, Diffusion.
Identifiers: Fluid mechanics.

A method was developed for estimating the age density of transporting elements at a transport surface by using the spectral density of the total element counts. Only total counts, and not individual element histories, need be observed. The method was compared with autocorrelation methods used in an earlier work. Residence times were measured for several sizes of particles at a particular wall surface of a stirred fluidized bed and at various gas velocities using both spectral density and autocorrelation methods. A dimensionless plot brought all data points near a single curve, valid only for this surface in this bed. Checks of these residence times against values obtained by direct observation of individual particles confirmed the methods. Heat transfer coefficients were measured for glass particle at the same wall surface of a fluidized bed for which glass particles residence times were measured in a previous study. The data compared well with theoretical predictions of the dependence of heat transfer coefficients on particle residence times. Heat transfer coefficients for metal particle systems, for which direct measurements of residence times were not available, were predicted with fair accuracy by estimating residence times from a dimensionless correlation proposed in a previous study. The ability of the particle surface renewal models to accurately predict heat transfer coefficients is strong evidence of their physical validity. (Novotny-Vanderbilt)
W71-00648

THERMODYNAMIC PROPERTIES OF LIQUID H2O AND D2O AND THEIR MIXTURES,
National Aeronautics and Space Administration, Cambridge, Mass. Electronics Research Center.
Mark Salomon.
For sale by NTIS as NASA TND-5223, $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Technical Note D-5223, May 1969. 12 p, 5 tab, 27 ref.

Descriptors: *Water properties, *Deuterium, Thermodynamics, *Enthalpy, Thermal properties, Data collections, Physicochemical properties, Chemical properties, Chemical reactions.
Identifiers: Equilibrium constants.

The liquid and gas phase equilibria H2O .. D2O — HDO have been reinvestigated. By combining spectroscopic and vapor pressure data, fairly good agreement is found between the experimental and calculated enthalpy for the liquid phase reaction. The value of the equilibrium constant for the liquid phase reaction is very close to the geometric mean value of 4.0. (Knapp-USGS)
W71-00887

1B. Aqueous Solutions and Suspensions

ADSORPTION OF ORGANIC COMPOUNDS ONTO SOLIDS FROM AQUEOUS SOLUTIONS,
Virginia Polytechnic Inst., Blacksburg.
James P. Wightman, Leslie R. Dole, Clarence A. King, and Russell K. Lengel.
Available from NTIS as PB-195 309, $3.00 in paper copy, $0.95 in microfiche. Virginia Water Resources Research Center Bulletin, Completion Report, October 1970. 12 p. OWRR Project A-026-VA (1).

Descriptors: *Adsorption, *Surface tension, *Surfaces, Aqueous solutions, Phenol, Polarity, Wettability.
Identifiers: *Gas chromatography, *Surface area, *Critical surface tension, Infrared spectra, Polymers.

The research involved a study of factors effecting adsorption of phenol from aqueous solution on six solids of varying polarity including polymers of known surface area. The amount of phenol adsorbed over a wide range of phenol concentration was determined by a gas chromatographic technique. The critical surface tensions of the polymers were determined by contact angle measurements. Reflection infrared spectra were obtained on the powdered solids. Anomalously large quantities of phenol were taken up by microcrystalline Nylon presumably by an adsorption process.
W71-00633

INFLUENCE OF SURFACE TURBULENCE AND SURFACTANTS ON GAS TRANSPORT THROUGH LIQUID INTERFACES,
California Univ., Berkeley.
Thomas G. Springer, and Robert L. Pigford.
Industrial Engineering Chemical Fundamentals, Vol 9, (1970), No 3, p 458-465. 8 fig, 5 tab, 17 ref.

Descriptors: *Boundary processes, *Air-water interfaces, Mass transfer, Heat transfer, Evaporation, Convection, *Turbulence, Statistical models, Mathematical models, Diffusion, *Surfactants.

A new experimental technique is used to measure the effects of surface turbulence and surfactants on mass transfer rates at gas-liquid interfaces. At high turbulence rates the statistical nature of interfaces, with and without surfactants present, may be described by a Danckwerts-type distribution function of surface ages. Measurements of surface film mass transfer resistances show that soluble surfactants offer no measurable resistance, while insoluble films show definite resistance to passage of gas molecules. The nature of surface films and their stability in the presence of interfacial turbulence are discussed. The results were drawn from data taken at high turbulence rates, where the scale of turbulence was much greater than the depth of penetration of the dissolving gas. In all turbulent runs, no visual change in the surface turbulence could be seen. (Novotny-Vanderbilt)
W71-00646

ION-ION AND ION-MOLECULE INTERACTIONS IN AQUEOUS SALT SOLUTIONS,
Connecticut Univ., Storrs. Inst. of Water Resources.
W. L. Masterton.
Available from NTIS as PB-195 312, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, June 30, 1970. 5 p. OWRR Project A-013-CONN (7).

Descriptors: Osmosis, *Ions, *Electrolytes.
Identifiers: *Salt effect, *Osmotic coefficient, Complex ion electrolyte, Apparent molal value, Activity coefficient, Partial molal value, Solubility nonelectrolytes, Ion pair, Conductivity.

Studies have been carried out on the thermodynamic properties and structure of aqueous solutions of complex ion electrolytes derived from cobalt (III). The work involves the determination of osmotic and activity coefficients, conductivities, salt effects and partial molal volumes. The data indicates that complex ion electrolytes in aqueous solution are more strongly ion paired than simple salts of the same valence type. Aromatic hydrocarbons are salted in by complex ion electrolytes.
W71-00705

THERMODYNAMIC PROPERTIES OF LIQUID H2O AND D2O AND THEIR MIXTURES,
National Aeronautics and Space Administration, Cambridge, Mass. Electronics Research Center.
For primary bibliographic entry see Field 01A.
W71-00887

PROTON MAGNETIC RESONANCE STUDY OF COUNTERION AND SOLVENT EFFECTS ON 14N QUADRUPOLE RELAXATION IN TETRAALKYLAM-MONIUM IONS,
Missouri Univ., Kansas City. Dept. of Chemistry.
David W. Larsen.
Journal of Physical Chemistry, Vol 74, No 18, p 3380-3384, September 1970. 2 fig, 1 tab, 26 ref. OWRR Project A-022-MO (1).

Descriptors: *Electrolytes, Aqueous solutions, *Ions, *Soluation, Water properties, Water structure, Equilibrium, Ionization, Diffusion, Viscosity.
Identifiers: *Ion pairing, Detergents.

Nuclear magnetic resonance lineshapes for ocmethyl protons in (CH3)4N (..) and (CH3)3NCH2CH3 (..) salts were studied. The dependence of the lineshapes on salt concentration, added electrolyte concentrations, solvent, and temperature was studied. The observed effects are caused by the N (14) quadrupole relaxation rate, which is governed by the nature of fluctuating field gradients at the N (14) nucleus. Electric field gradients and correlation times are discussed in terms of structure of the cations, solvent interactions, and ion pairing. The small temperature dependence of the lineshapes suggests that the correlation decay mechanism is rotation of the cation. The results are interpreted in terms of contact ion pairs in dimethyl-sulfoxide solution and solvent separated ion pairs in aqueous solution. The present results for R4N (..)X (-) ion pairs are in agreement with previous results for R4N (..)MXn (3-) ion pairs from studies of n.m.r. pseudocontact effects.
W71-00943

02. WATER CYCLE

2A. General

PREDICTING AND MAPPING THE AVERAGE HYDROLOGIC RESPONSE FOR THE EASTERN UNITED STATES,
Georgia Univ., Athens.
James F. Woodruff, and John D. Hewlett.
Water Resources Research, Vol 6, No 5, p 1312-1326, October 1970. 15 p, 4 fig, 3 tab, 10 ref. OWRR Project A-d18-GA.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Mapping, *Small watersheds, Synoptic analysis, Drainage patterns (Geologic), Maps, Runoff forecasting, Streamflow forecasting, Discharge (Water), Data collections, Hydrologic data, Hydrogeology, Flood forecasting, Water storage, Stream gages, Gaging stations.

An attempt was made to predict the average annual hydrologic response (ratio of annual direct runoff to annual precipitation) of ungaged watersheds in the East by regression against 15 planimetric, hypsometric, and land use factors available on 90 selected test basins (2 to 100 square miles) from New York to Alabama. The regression coefficients were nonsignificant indicating that the average percentage of a basins's annual precipitation that will become quick flow cannot be predicted from available basin morphometry and implying that response is controlled chiefly by porous mantle factors not measurable on normal data sources. A hydrologic response map of the eastern United States based on an expanded set of 201 basins up to 200 square miles revealed specific regions of high flood producing potential clearly related to geologic provinces. It is suggested that hydrologic response is a meaningful parameter that may be best derived by measuring precipitation and

streamflow by cheap, short-term methods traditionally rejected as uneconomical. (Knapp-USGS)
W71-00551

RECESSION AND THE BASEFLOW PROBLEM,
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 02E.
W71-00577

THEORETICAL ESTIMATES VERSUS FOREST WATER YIELD,
West Virginia Univ., Morgantown. Div. of Forestry.
For primary bibliographic entry see Field 03B.
W71-00587

PARTIAL AREA CONTRIBUTIONS TO STORM RUNOFF IN A SMALL NEW ENGLAND WATERSHED,
Agricultural Research Service, Danville, Vt.
Thomas Dunne, and Richard D. Black.
Water Resources Research, Vol 6, No 5, p 1296-1311, October 1970. 16 p, 11 fig, 1 tab, 16 ref.

Descriptors: *Storm runoff, *Rainfall-runoff relationships, *Small watershed, *Overland flow, Soil water movement, Hydrogeology, Soil water, Permeability, Precipitation excess, Depth-area-duration analysis, Percolation, Rainfall disposition.
Identifiers: Sleepers River Experimental Watershed (Vt).

During an experimental study of runoff producing mechanisms in a small drainage basin, the major portion of storm runoff was produced as overland flow on a small proportion of the watershed. Where the water table intersected the ground surface before and during a storm, water ran quickly to the stream at velocities 100 to 500 times those of the subsurface system. Direct precipitation onto the saturated area was another major contributor of storm flow. Storage of water was small and travel times out of them were short. These areas contributing quick runoff could expand or contract seasonally or during a storm. Their position and expansion can be related to geology, topography, soils, and rainfall characteristics. In the study basin, water that remained below the ground surface on its way to the main stream channel was a relatively minor contributor to the storm hydrograph. Measurements of water table elevation and runoff from experimental plots in another small watershed with different geologic conditions confirmed the results. Runoff records from a large number of small basins of the Sleepers River experimental watershed indicate the general applicability of these findings. (Knapp-USGS)
W71-00588

MODELING THE EFFECT OF LAND USE MODIFICATIONS ON RUNOFF,
Agricultural Research Service, Brookings, S. Dak.; and Water Resources Board, Reading (England).
For primary bibliographic entry see Field 04C.
W71-00589

NONLINEAR TIME VARYING MODEL OF RAINFALL-RUNOFF RELATION,
Pittsburgh Univ., Pa.
Chao-Lin Chiu, and J. T. Huang.
Water Resources Research, Vol 6, No 5, p 1277-1286, October 1970. 10 p, 16 fig, 7 ref. OWRR Project C-1146.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Hydrograph analysis, Time series analysis, Parametric hydrology, Systems analysis.
Identifiers: Non-linear models.

The developed nonlinear time varying model of a hydrologic system that relates the rainfall and the runoff is represented by a pair of nonlinear ordinary differential equations with time varying coefficients. The model does not require the linearity and time invariance assumptions necessary in conventional unit hydrograph methods. The nonlinear and time varying characteristics of the system are incorporated into the model through four basic system parameters. The model is empirical and its field application procedure is feasible and simple, since its derivation is based on the physical system response observed. In an illustrative field application the model and procedure proved effective, relative to other linear time invariant models, in predicting the rain-runoff relation, especially when the rainfall excess occurred during a very short time interval. (Knapp-USGS)
W71-00590

ON THE WATER BALANCES OF SOME INDIAN STATIONS,
Meteorological Office, Poona (India).
For primary bibliographic entry see Field 02D.
W71-00595

WATER BALANCE OF LAKE CHALA AND ITS RELATION TO GROUNDWATER FROM TRITIUM AND STABLE ISOTOPE DATA,
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02H.
W71-00601

AN UNCONVENTIONAL APPROACH TO FLOOD FREQUENCY ANALYSIS,
Technion - Israel Inst. of Tech., Haifa.
Joseph S. Dalinsky.
Bulletin International Association of Scientific Hydrology, Vol 15, No 3, p 55-59, September 1970. 5 p, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, *Flood forecasting, *Frequency analysis, Rain gages, Data collections, Hydrologic data, Meteorological data, Data processing, Digital computers, Mathematical models.
Identifiers: Flood frequency.

It is suggested that flood-frequency analysis be based on regional rainfall analysis, a combination of physical and statistical analyses making use of all data. The statistical analysis should refer mainly to rainfall data. Rainfall data are more numerous, especially as data from a number of stations of the same region can be used simultaneously or alternately, as long as their rainfall regimes and rainfall quality are identical. Rainfall data are more reliable and easier to measure. Rainfall is stochastic. Generally, the known frequency distribution of rainfall intensities of different durations is log-normal, or nearly so. An analysis of rainfall-runoff relations should be based not only on all reliable data, but also on an understanding of the physical nature of hydrologic processes. (Knapp-USGS)
W71-00861

ON THE COMPUTER EVALUATION OF THIESSEN WEIGHTS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
M. H. Diskin.
Journal of Hydrology, Vol 11, No 1, p 69-78, July 1970. 10 p, 2 fig, 2 tab, 2 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff forecasting, *Computer programs, *Small watersheds, *Routing, Hydrograph analysis, Networks, Data processing, Rain gages, Digital computers.
Identifiers: Thiessen weights, Thiessen method.

To shorten the time required for rainfall-runoff calculations in watersheds, an improved method is presented for evaluating the Thiessen weights or coefficients by a digital computer. The new method is based on covering the area of the watershed with uniform, equally spaced test points on a rectangular grid and assigning each such point to the nearest rain-gaging station. The number of points assigned to any station relative to the total number of points that fall inside the boundaries of the watershed gives the weight of the station. The new procedure is faster and gives more accurate results than a previous program based on random test points. The complete listing of the new computer program in Fortran IV may be obtained from the author or from the Southwest Watershed Research Center Tucson, Arizona. (Knapp-USGS)
W71-00864

RESPONSE UNITS FOR EVALUATING THE HYDROLOGIC PERFORMANCE OF RANGELAND WATERSHEDS,
Agricultural Research Service, Boise, Idaho Northwest Watershed Research Center.
For primary bibliographic entry see Field 02G.
W71-00866

CLOUD SEEDING, AREA OF EFFECT NUMERICAL MODEL,
Aerometric Research, Inc., Goleta, Calif.
For primary bibliographic entry see Field 02B.
W71-00912

RANGE RESOURCES AND WATERSHED MANAGEMENT--A NEED FOR RESEARCH,
Utah State Univ., Logan. Dept. of Range Science.
For primary bibliographic entry see Field 04D.
W71-00959

TRITIUM IN SURFACE WATER HYDROLOGY EXPERIMENTAL DETERMINATION OF THE RUNOFF COEFFICIENT (FRENCH),
Bureau of Geological and Mining Research, Orléans (France).
Edith Crouzet, Pierre Hubert, Philippe Olive, Erik Siwertz, and Adrien Marce.
Journal of Hydrology, Vol 11, No 3, p 217-22[illegible] September 1970. 13 p, 7 fig, 5 tab, 6 ref.

Descriptors: *Surface-groundwater relationship *Rainfall-runoff relationships, *Floods, *Tracki techniques, *Tritium, Hydrogeology, Subsurfa runoff, Hydrograph analysis, Hydrologic cycl Tracers, Base flow, Discharge (Water), Infiltratio Overland flow, Rainfall disposition.
Identifiers: France.

To establish the relative proportions of surface-r noff and groundwater discharge it is possible measure the amounts of tritium in rainwate groundwater, and the outflow from a particul drainage basin. From such data, the part of t total discharge due to direct runoff can established. At Pont des Blaves, France, the great part of the flood waters passing on 11/7/1968 a peared to consist of displaced groundwater. To lesser extent this proved also to be the case with t discharge at Charmoisy (2/8/1968), situated with the same drainage basin. On the other hand, t discharge at Verthier (23 to 29/12/1968) was la gely due to precipitation. Earlier radiometr methods have used Sr-90 and Cs-137 as indicato Tritium, however, is to be preferred because it not adsorbed by the soil. The proposed meth should give insight into water balance and esp cially into the hydrological cycle in drainage basi (Knapp-USGS)
W71-01060

THE PROGRESS OF HYDROLOGY: VOL NEW DEVELOPMENTS IN HYDROLOGY.
Illinois Univ., Urbana.

Ven Te Chow, Chairman. Proceedings 1st Intern tional Seminar for Hydrology Professors, Illin University, Urbana, July 13-25, 1969, published Univ of Illinois, 1969. 509 p.

Descriptors: *International Hydrological Decade, *Conferences, *Research and development, *Water resources development, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Exploration, Economics, Instrumentation, Laboratories, Model studies, Technology, Computers.
Identifiers: *Water resources research.

In recent years there has been a tremendous amount of activity in the field of hydrology. The International Hydrological Decade which began in 1965 is just one example of such activities. As it is generally recognized that the science of hydrology is basic to all plans of water resources development, new national and international attention and interest in water resources have further stimulated the progress of hydrology. These activities have exposed two significant facts: (1) new technologies applicable to hydrology are being rapidly developed, and (2) urgent need for modern hydrologic education is well recognized in government as well as in scientific communities. As a first step to meet the need for a progressive hydrologic education, an International Seminar for Hydrology Professors was held from July 13 to 25, 1969, in Urbana, Illinois, U.S.A. The theme of the seminar was limited to new developments in the field of hydrology, to hydrologic teaching and research at colleges and universities, and to the relation of hydrology with governments, society and professions. A total of 62 papers were presented and preprinted for distribution at the seminar. Of these papers, 20 were on new developments in hydrology, 19 on specialized subjects in hydrology, 10 on hydrologic education, and 13 on various country reports. (See also W71-01068 thru W71-01087) (Knapp-USGS)
W71-01067

SOME OF ESSA'S CURRENT EFFORTS IN SATELLITE DATA APPLICATIONS FOR HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-01068

SPACE TECHNOLOGY IN HYDROLOGIC APPLICATIONS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-01069

REMOTE SENSING IN SPACE TECHNOLOGY IN HYDROLOGY,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07B.
W71-01070

SCIENTIFIC HYDROLOGY IN THE UNITED STATES,
Illinois Univ., Urbana. Dept. of Civil Engineering.
William C. Ackermann.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 50-60, published by Univ of Illinois, 1969. 11 p, 1 fig.

Descriptors: International Hydrological Decade, Conferences, *Research and development, *Water resources development, *Systems analysis, Social aspects, Forecasting, Hydrology, Hydraulics, Water pollution control, Water quality, Remote sensing, Statistics, Planning, Projects, Research facilities, Exploration, Economics, Instrumentation, Laboratories, Model studies, Technology, Computers.
Identifiers: *Water resources research.

Over the past 50 years hydrology has evolved from a largely descriptive science of the natural hydrologic cycle. Hydrology is in the process now of adapting technologies which have come in part from outside of hydrology for improved sensing, statistical evaluation, electronic calculation, and systems analyses. One of societies' problems is with quality of the environment, and a part of the response to this should be by far greater concern with natural and degraded water quality as well as the traditional concern with quantity. (See also W71-01067) (Knapp-USGS)
W71-01071

SCIENTIFIC HYDROLOGY IN THE WORLD,
Utah State Univ., Logan. Coll. of Engineering.
Dean F. Peterson.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 26-49, published by Univ of Illinois, 1969. 24 p, 2 tab, 9 ref.

Descriptors: International Hydrological Decade, Conferences, *Research and development, *Water resources development, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Exploration, Economics, Instrumentation, Laboratories, Model studies, Technology, Computers.
Identifiers: *Water resources research.

The present state of the science of hydrology is summarized for an IHD seminar held in 1969. A major part of international scientific effort in hydrology falls within the program of the International Hydrological Decade which, first proposed in 1961 was implemented under a Coordinating Council of UNESCO January 1, 1965. Efforts of the IHD fall into the general categories of (1) basic data; (2) inventories and water balances; (3) research projects; (4) exchange of information, symposia and publication, and (5) education and training in hydrology. The developing countries tend to place highest priority on development of their resources in order to meet the extremely pressing needs for economic growth; whereas, the developed countries tend to give relatively higher priority to environmental problems as such, and to the more sophisticated scientific problems. (See also W71-01067) (Knapp-USGS)
W71-01072

DETERMINISTIC NONLINEAR HYDROLOGIC MODELS,
Geological Survey, Washington, D.C.
J. Amorocho.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 420-472, published by Univ of Illinois, 1969. 53 p, 12 fig, 37 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Research and development, *Model studies, *Mathematical models, Parametric hydrology, Forecasting, Hydrology, Hydraulics, Simulation analysis, Input-Output analysis, Operations research, Planning, Research facilities, Systems analysis, Model studies, Technology, Computers.
Identifiers: *Water resources research.

The deterministic approach has been very fruitful in the development of a number of techniques for the representation of various elements of the hydrologic cycle, and has led to useful results in practical application. Completely general models applicable to all circumstances are not available, but such generality may neither be necessary nor entirely desirable. While the types of models discussed operate in a deterministic manner on the input data supplied, the results of their operation must always be interpreted in a statistical sense. New techniques to handle the model uncertainties in terms of the risk associated with the use of model outputs are needed to make these methods truly effective for water resources planning and design. (See also W71-01067) (Knapp-USGS)
W71-01081

RECENT DEVELOPMENTS IN MEASURING TECHNIQUES FOR FLOW IN OPEN CHANNELS,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 07B.
W71-01085

PRINCIPLES OF THE APPLICATION OF NUCLEAR TECHNIQUES TO HYDROLOGIC INVESTIGATIONS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W71-01086

NUCLEAR TECHNIQUES IN HYDROLOGY,
International Atomic Energy Agency, Vienna (Austria). Section of Hydrology.
For primary bibliographic entry see Field 07B.
W71-01087

POSSIBILITY OF FORECASTING THE AREAL WATER TEMPERATURE DISTRIBUTION,
M. G. Glagoleva.
Translation from Trudy GMTs, No 51, p 75-85, 1969. Soviet Hydrology: Selected Papers, Issue No 3, p 252-257, 1969. 6 p, 5 fig, 3 tab, 7 ref.

Descriptors: *Water temperature, *Forecasting, *Oceans, *Atlantic Ocean, *Areal, Surface waters, Atmospheric pressure, Meterological data, Fishing, Mathematical studies, Computer programs, Equations, Regression analysis, Foreign projects.
Identifiers: *Russia, North Atlantic.

Methods of utilizing hydrometerological data to forecast areal ocean-water temperatures (needed as an aid in the fishing industry) are described. A mathematical method of comparing the atmospheric pressure with the water temperature distribution in the North Atlantic from data collected on weather ships is emphasized. The ocean water temperature in summer is determined mainly by the state of the atmosphere in the preceding winter. Therefore, the distribution of water temperature anomalies at the surface in the North Atlantic in August was compared with the pressure field over the ocean and neighboring regions in January and February. The coefficients of expansion in series of natural components were used as the indexes of the water temperature and atmospheric pressure fields. Equations were obtained on an electronic computer for each coefficient of the field of water temperature anomalies by the method of multiple correlations. Similar equations for forecasting the coefficients of the field of water temperature anomalies were obtained for other months. The study shows not only that long-range water temperature forecasts can be issued for individual points, but also that the areal distribution of water temperature can be forecast. Related maps, graphs, and tables of data are included. (Woodard-USGS)
W71-01090

CAUSES OF LONG-PERIOD STREAMFLOW FLUCTUATIONS,
N. P. Smirnov.
Translation from (Izvestiya VGO), Vol 10, No 5, p 433-440, 1969. Soviet Hydrology: Selected Papers, Issue No 3, p 308-314, 1969. 7 p, 5 fig, 27 ref.

Descriptors: *Streamflow, *Fluctuation, *Climatic data, Solar radiation, Earth (Planet), Polarity, Atmosphere, Tides, Rivers, Flow rates, Gravity.
Identifiers: *Earth rotation, Volga River, Dnieper River (USSR).

Physiography factors and climatic conditions concerning causes of fluctuations in the supply of water and flow of rivers over long periods are discussed. The influences of extraterrestrial factors on climate are emphasized with relationship graphs constructed from data pertaining to the Volga and Dnieper Rivers in the USSR as follows: (1) Comparison of variations of the long-period part of the tide-producing force with flow anomalies of the

Volga at Volgograd, (2) comparison of variations in the long-period part of the tide-producing force with flow anomalies of the Dnieper at Kiev, (3) comparison of mean annual relative sunspot numbers with the flow anomalies of the Volga at Volgograd, (4) comparison of the Y component of the radius-vector of the pole of rotation of the earth in February with flow anomalies of the Volga at Volgograd, and (5) comparison of the Y component of the radius-vector of the pole of rotation of the earth in February with flow anomalies of the Dnieper at Kiev. The results indicate that flow fluctuations are governed largely through atmospheric circulation by variations in tide-producing forces, solar activity, and the forces of deformation arising from the nutational fluctuations of the pole of rotation of the earth. (Woodard-USGS)
W71-01091

APPROXIMATE ESTIMATE OF THE POSSIBLE UTILIZATION OF THE WATER RESOURCES OF KAZAKHSTAN,
P. F. Lavrent'yev, and L. D. Lavrent'yeva.
Translation from Trudy KazNIGMI, No 32, p 89-99, 1969. Soviet Hydrology: Selected Papers, Issue No 3, p 270-279, 1969. 10 p, 2 fig, 5 tab, 6 ref.

Descriptors: *Water supply, *Water resources, *Surface waters, *Water utilization, *Foreign projects, Rivers, Runoff, Streamflow, Reservoirs, Water yield, Water loss, Water storage, Precipitation (Atmospheric).
Identifiers: *Kazakhstan (USSR).

Data of developed projects for long-period storage reservoirs were used to estimate the surface water resources that can be practically utilized in Kazakhstan, U.S.S.R. The coefficient of flow utilization which characterizes the ratio of the maximum economically feasible volume of regulated net yield to the mean annual volume of the potential surface-water resources, was used as the conversion factor from potential surface-water resources to the resources that can be utilized in practice. The flow-utilization coefficient corresponds to a given probability of yield. Most of the large rivers of Kazakhstan are of importance to several republics and countries since the upper parts of their basins are located outside the borders of the republic. Therefore, in estimating the water resources of Kazakhstan that can be used in practice, allowance must be made for the requirements of neighboring republics and countries. Related maps, graphs, and tables of data are included. (Woodard-USGS)
W71-01092

FOREST HYDROLOGY AND EXTREME RAINFALL FREQUENCY,
Missouri Univ., Columbia. School of Forestry.
Carl D. Settergren.
Water Resources Bulletin, Vol 6, No 5, p 775-783, September-October 1970. 9 p, 6 fig, 1 tab, 2 ref.

Descriptors: *Rainfall, *Frequency analysis, *Forests, Rainfall-runoff relationships, Hydrograph analysis, Runoff forecasting, Streamflow forecasting, Peak discharge.
Identifiers: Forest hydrology, Rainfall extremes.

Extreme rainfall frequency analysis provides a means to predict the average time interval between the recurrences of storms of a specified duration and magnitude. This furnishes the forest hydrologist a valuable tool for engineering design and runoff and erosion forecast. A modification in the application of the annual maximum and annual exceedance series analysis described by V. T. Chow can, for special purposes, lead to an even more useful estimate of extreme events on a seasonal basis. This can be particularly important on small forested headwater watersheds where the runoff response to extreme rainfall may vary considerably with seasonal changes in canopy cover and soil moisture characteristics. Under certain circumstances, for short-term recurrence interval forecast and for non-critical application, the analysis of extreme rainfall frequency from less than 20 years data seems justified. (Knapp-USGS)
W71-01099

2B. Precipitation

PREDICTING AND MAPPING THE AVERAGE HYDROLOGIC RESPONSE FOR THE EASTERN UNITED STATES,
Georgia Univ., Athens.
For primary bibliographic entry see Field 02A.
W71-00551

DETACHMENT OF SOIL AGGREGATES BY SIMULATED RAINFALL,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 02J.
W71-00556

SYNTHETIC GENERATION OF SEASONAL PRECIPITATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Lourens A. V. Hiemstra, and Robert C. Creese.
Journal of Hydrology, Vol 11, No 1, p 30-46, July 1970. 17 p, 3 fig, 3 tab, 13 ref. OWRR Project A-015-PA.

Descriptors: *Precipitation (Atmospheric), *Synthetic hydrology, *Mathematical models, *Simulated rainfall, Rainfall, Hydrographs, Markov processes, Monte Carlo method, Stochastic processes, Probability, Statistical models, Rainfall intensity, Pennsylvania, Simulation analysis.
Identifiers: Synthetic rainfall series.

An analytical model was developed for the synthesis of seasonal point precipitation at State College, Pennsylvania. This model was based on statistical properties of precipitation events obtained from 27 years of historical data. The means and variances of important precipitation characteristics were reasonably well preserved in the synthesized data. These characteristics include precipitation amounts, precipitation durations, length of dry periods between occurrences of precipitation events, and parameters describing the time patterns of precipitation intensities. The model utilized lognormal and lognormal bivariate distributions of the precipitation characteristics of interest. The lognormal bivariate distributions enabled the preservation of interdependence between selected variables in a Monte Carlo type of generation process. The seasonal cycle in precipitation was defined by subdividing the 365 days of the year into one period of 60 days and five periods of 61 days each, starting at January 1 of each year. The one extra day in leap years was ignored. Time patterns of precipitation intensities were described by the incomplete beta-function. Precipitation events were arbitrarily separated when a period without precipitation lasted for or exceeded 30 min. (Knapp-USGS)
W71-00600

CLIMATIC ATLAS OF NORTH AMERICA MEAN SEA AND LAKE SURFACE TEMPERATURES,
Weather Wing (4th), Ent AFB, Colo.
For primary bibliographic entry see Field 07C.
W71-00784

OBJECTIVE FORECASTS OF PRECIPITATION USING PE MODEL OUTPUT,
Weather Bureau, Garden City, N.Y. Eastern Region Headquarters.
Stanley E. Wasserman.
Available from NTIS as PB-193 378, $3.00 in paper copy, $0.95 in microfiche. July 1970. 13 p. Technical Memorandum ER-35.
Identifiers: *Weather forecasting, Atmospheric precipation, Probability, Mathematical models, Humidity, Moisture, *Objective weather forecasting.

The National Meteorological Centers Primitive Equation (PE) Model predictions of relative humidity, relative humidity trend and vertical velocity are found to be well correlated to frequency of observed precipitation at New York City during the period November through March. A technique is developed for using these PE predicitions to objectively forecast probability of precipitation (PoP). The technique is shown to have applications to other areas.
W71-00802

AN EQUATION FOR VORTEX MOTION INCLUDING EFFECTS OF BUOYANCY AND SOURCES WITH APPLICATIONS TO TORNADOES,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
Robert C. Costen.
For sale by NTIS as NASA TND 5964, $3.00 in paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Technical Note D-5964, October 1970. 62 p, 20 fig, 2 tab, 24 ref, 3 append.

Descriptors: *Tornadoes, *Vortices, *Equations, *Fluid mechanics, Hydrodynamics, Atmospheric pressure, Winds, Rotational flow, Mathematical models.
Identifiers: Jet stream effects (Atmospheric).

A new equation is derived for the motion of vorticity in a general fluid, including the effects of viscosity, compressibility, nonhomogeneity, and nonconservative forces. The equation holds, in particular, for vortices which may not move with the fluid. A linearized form of this equation is applied to tornado cyclones and to the twin tornado of April 11, 1965, near Elkhart, Indiana. It is shown that the displacement of tornado cyclones to the right of the mean tropospheric winds may be accounted for by the upward efflux of fluid from the cyclone into the jet stream. Also, the retarded revolution rate of the twin tornado may be due in part to an attractive 'buoyancy' force acting on the partially rarefied cores of the pair. (Knapp-USGS)
W71-00845

RAINFALL ENHANCEMENT BY DYNAMIC CLOUD MODIFICATION,
Environmental Science Services Admin., Miami Univ., Coral Gables, Fla.; and Atlantic Oceanographic and Meteorological Lab.
For primary bibliographic entry see Field 03B.
W71-00854

RIVERS OF DUST.

Chemistry, Vol 42, No 11, p 24, December 1969. p, 1 fig.

Descriptors: *Dust storms, *Air circulation, *Fallout, Eluvium, Weather modification, Cloud seeding, Hurricanes, Atlantic Ocean, Cores, Sediment distribution, Satellites (Artificial), Remote sensing.
Identifiers: *Sahara Desert dust, Ocean sediments.

Red dust originating as dust storms on the Sahara Desert has been found in the atmosphere 3 mi above the Atlantic Ocean. The dust flows west with the trade winds, at a rate of about 15 mi per hour until it reaches the Caribbean near Cuba about 3,000 mi away. There, it splits into three small streams; one crosses Central and South America, another the United States, and the third moves into the north Atlantic. The dust river may influence weather and even play a part in hurricane formation. Discovered accidentally in Barbados in 1965 by British scientists searching for cosmic dust, daily measurements show a peak during the summer when large sand storms are more frequent in the Sahara. Satellite photographs show that it takes about a week for dust to travel from Africa to Barbados. In addition to being useful for tracing atmospheric patterns from satellites, the dust may lead to a better understanding of ocean sediments. Some cores from the Atlantic areas affected by the

dust river have shown material that can be traced to Africa. (Land-USGS)
W71-00886

ATMOSPHERIC AEROSOL: DOES A BACKGROUND LEVEL EXIST,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
William M. Porch, Robert J. Charlson, and Lawrence F. Radke.
Science, Vol 170, No 3955, p 315-317, October 16, 1970. 3 p, 1 fig, 1 tab, 13 ref.

Descriptors: *Aerosols, *Atmosphere, *Atmospheric physics, Air environment, Light penetration, Instrumentation, Data collections, Remote sensing, Measurement.
Identifiers: *Atmospheric aerosols, *Background level, World climate.

To determine a background level of atmospheric aerosol, for comparison with increases measured in the past 20 years and speculation on the effect of increasing aerosol on World climate, and for use in efforts to control air pollution, measurements of light-scattering were made at Point Barrow, Alaska, and Mount Olympus, Washington. These measurements agree in magnitude, and both sets of data are in agreement with other measurements of light-scattering and turbidity made in remote locations. Results suggest that a background level of aerosol does exist and that the concept of a background is applicable. Background values of the scattering component of the extinction coefficient of air are tabulated for 9 locations. Records are for varying time intervals from 1963 to 1970. The nephelometer was used at 5 of the locations, the Bolz sunphotometer at 3, and a searchlight at the other. (Lang-USGS)
W71-00910

CLOUD SEEDING, AREA OF EFFECT NUMERICAL MODEL,
Aerometric Research, Inc., Goleta, Calif.
Robert D. Elliott.
Report, January 1969, revised. 67 p, 12 tab, 27 fig, 9 ref, 3 append.

Descriptors: *Cloud seeding, *Numerical models, Precipitation (Atmospheric), *Weather modification, Model studies, Weather patterns, Weather forecasting, Storms, Storm structure.

A computerized numerical seeding area of effect model is presented for the orographic winter storm situation. The required inputs are: Vertical profile of wind, temperature, and moisture in the air mass approaching the barrier; The artificial nucleant source strength production curve, and position; Topographic data over the area of interest. Outputs include an outline of the area in which seeding will enhance precipitation. The model handles both the laminar flow and the convection cases. Drift, diffusion, nucleation, growth and fallout from the ground plume is predicted. The model includes a nuclei/water vapor/liquid water/ice/precipitation budget. Growth by both diffusion and accretion is maintained. In the case of convection, growth and fallout of precipitation particles from a tilted convection column to the ground is predicted. A prediction can also be made for an aerial source. Provision is made for reading out in 50-second computational steps the status of all parameters within the ground plume, convection columns, and the fallout therefrom to ground level. The model reproduces results in accord with information gleaned from seeding test projects. It also successfully predicts the temperature dependent division into positive and negative effects found by Grant and Mielke in their statistical analysis of seeding effects in the Rockies.
W71-00912

PROBABLE MAXIMUM PRECIPITATION, MEKONG RIVER BASIN,
Environmental Science Services Administration, Washington, D.C.
John T. Riedel, and Francis K. Schwartz.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.25. Hydrometeorological Report, No 46, May 1970. 152 p, 60 fig, 71 ref, append.

Descriptors: Design flood, Maximum probable flood, *Precipitation, Spillways, *Probable maximum precipitation, Weather patterns, Storms.
Identifiers: Typhoon rainfall, *Mekong River Basin, Cambodia, Laos, Thailand, Vietnam, China, *Rainfall climatology.

This study is divided into two main parts. The first gives generalized estimates of probable maximum precipitation (PMP) for the Mekong River Basin south of the China border. Drainage areas covered range from 5000 to 25,000 km (2) in size. The prototype to the PMP storm is a typhoon crossing the Vietnam coast into the Mekong River Basin. The second part gives rainfall estimates for calculating the probable maximum flood at three potential dam sites on the Mekong River. These sites and the drainages involved are Luang Prabang, Laos, 262,000 km (2), Pakse, Laos, 539,000 km (2) and Kratie (Sambor) Cambodia, 646,000 km (2). The criteria for these large basins consist of rainfall frequencies over large subareas for the entire southwest monsoon rainy season, and portions thereof, along with rainfall from two critically-spaced typhoons. (Thompson-ESSA)
W71-00945

THE FULL-GLACIAL CLIMATE IN THE SOUTHWESTERN UNITED STATES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
For primary bibliographic entry see Field 02C.
W71-00947

FOREST HYDROLOGY AND EXTREME RAINFALL FREQUENCY,
Missouri Univ., Columbia. School of Forestry.
For primary bibliographic entry see Field 02A.
W71-01099

THE ISOLATION OF RANDOM ERRORS IN PERIODIC RAINFALL,
Calgary Univ., Alberta. Dept. of Geography.
For primary bibliographic entry see Field 07C.
W71-01100

2C. Snow, Ice, and Frost

DIRECT READING FROST GAGE IS RELIABLE, INEXPENSIVE,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W71-00913

THE USE OF ENVIRONMENTAL SATELLITE DATA FOR MAPPING ANNUAL SNOW-EXTENT DECREASE IN THE WESTERN UNITED STATES,
Allied Research Associates, Inc., Concord, Mass.
James C. Barnes, and Clinton J. Bowley.
Final report for the Environmental Science Services Administration, June 1970. 105 p, 6 tab, 16 fig, 10 ref, append.

Descriptors: *Snow cover, *Snowmelt, *Snow surveys, *Remote sensing.
Identifiers: Satellite data, Columbia River Basin, Salt River Basin, Southern Sierra Nevada Region.

Techniques to map areal snow extent from satellite photography were tested during the 1967 and 1969 snowmelt seasons in three regions of characteristically different terrain, forest cover, and snowfall climatology in the western United States. Principal data sample used was AVCS photography from ESSA satellites. Also examined were IDCS photographs and Daytime HRIR data from the Nimbus III satellite. Snow-extent measurements from aerial surveys were used as ground-truth data. Results indicate that of the three regions tested satellite imagery provides the most reliable measurements of snow extent in the southern Sierra Nevada in California. For typical river basins in this region, snow extent in terms of percentage of basin covered can be determined to within plus or minus 5% of the aerial-survey measurement. In the Upper Columbia Basin in Idaho and Montana, satellite snow mapping is less reliable because of excessive springtime cloudiness and more densely forested mountain ranges with less horizontal snow-cover extent. In the Salt River Project Area in Arizona shallower snow depths can be mapped because of the sparse vegetation. (Thompson-ESSA)
W71-00946

THE FULL-GLACIAL CLIMATE IN THE SOUTHWESTERN UNITED STATES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
Robert W. Galloway.
Association of American Geographers, Annals, Vol 60, No 2, p 245-256, June 1970. 5 fig, 4 tab, 64 ref.

Descriptors: *Glacial soils, *Playas, *Hydrologic cycle, *Climatic data, *Paleoclimatology, Evaporation, Precipitation (Atmospheric), Runoff, Lakes, Solifluction, Arizona, New Mexico, Arid lands, Temperature, On-site investigations, Southwest U.S., Inflow, Climatology.
Identifiers: *Pluvial climate, *Full-glacial lakes, *Periglacial solifluction deposits, *Lake formation.

Studies on full-glacial closed lakes in the Southwestern U.S. have led to the general conclusion that the last glacial period (23,000-17,000 B.P.) had a generally wet, pluvial climate. Temperatures of the period may be estimated from periglacial solifluction deposits which indicate mean summer temperatures 10 degrees (centigrade) lower than the present arid climate and mean winter temperatures 11 degrees lower. In order to evaluate the significance of this and other full-glacial climatic data in terms of the hydrologic cycle, 8 conservative assumptions were made relating temperature, lake evaporation and inflow, precipitation and runoff. The validity of these assumptions are discussed in terms of existing data. Precipitation on several full-glacial lakes in Arizona and New Mexico was calculated from estimates of evaporation and inflow. It appears that as a result of the prevailing low temperatures, precipitation was somewhat less than present levels, but evaporation was less than one-half, and the large differences between the two led to lake formation. Although the evidence is still inconclusive, it is felt that the theory of pluvial conditions is probably incorrect. (Casey-Arizona)
W71-00947

SNOW COVER EVAPORATION IN THE SEMIDESERT ZONE OF KAZAKHSTAN,
For primary bibliographic entry see Field 02D.
W71-01093

2D. Evaporation and Transpiration

EXTRACTION TERM MODELS OF SOIL MOISTURE USE BY TRANSPIRING PLANTS,
Stanford Univ., California.
For primary bibliographic entry see Field 02I.
W71-00586

ON THE WATER BALANCES OF SOME INDIAN STATIONS,
Meteorological Office, Poona (India).
B. Padmanabhamurty, C. V. V. Satyanarayana Rao, and J. Dakshinamurti.
Journal of Hydrology, Vol 11, No 2, p 169-184, August 1970. 16 p, 1 fig, 11 tab, 16 ref.

Descriptors: *Evapotranspiration, *Water balance, *Humid areas, *Tropical regions, Humid climates, Arid lands.
Identifiers: India.

Water balances of some Indian stations situated in various climatic zones have been evaluated by employing the Potential Evapotranspiration values of Thornthwaite and Penman. Annual Potential Evapotranspiration of many stations is higher in the case of Thornwaite than Penman; sometimes to an extent of 26%. (Knapp-USGS)
W71-00595

HEAT AND MASS TRANSFER IN A CHANNEL WITH SURFACE MASS ADDITION: APPLICATION TO PHASE CHANGE PROCESSES,
Minnesota Univ., Minneapolis.
E. M. Sparrow, and H. S. Yu.
AIChE Journal, 16, No 4, 1970, p 588-594. 9 fig, 7 ref.

Descriptors: *Heat transfer, *Mass transfer, Channel flow, Evaporation, Air-water interfaces, Turbulence, Air temperature, Hydraulic water temperature, Thermal properties, Heat budget, Properties, Diffusion properties, Density, Momentum transfer, Reynolds number, Turbulent flow.
Identifiers: Fluid mechanic slushes.

The heat and mass transfer processes in a binary mixture flowing in a parallel plate channel with mass addition at the bounding surfaces are investigated analytically. The rate of mass addition, the temperature, and the mass fraction are arbitrarily prescribed at each of the bounding walls. Similarity solutions are evaluated numerically to yield pressure gradient, Nusselt number, and Sherwood number results for a wide range of each of three governing parameters. Increasingly strong surface mass addition markedly increases the magnitude of the axial pressure gradient. Mass addition decreases the Nusselt and Sherwood numbers at the channel wall at which the injection is strongest but may actually increase these moduli at the opposite wall. A generalizing analysis is performed to accommodate phase change processes as well as to accommodate the specification of plenum conditions rather than wall surface conditions. Application is made to the evaporation of liquid water by air stream. The rate of evaporation is augmented as the rate of air injection increases, but the extent of the augmentation is less than the causative increase in the air flow rate. (Novotny-Vanderbilt)
W71-00655

HYDRODYNAMIC STABILITY OF BOUNDARY LAYERS WITH SURFACE MASS TRANSFER,
Drexel Univ., Philadelphia, Pennsylvania.
F. K. Tsou, and E. M. Sparrow.
Applied Scientific Research, Vol 22, No 314, p 273-286, May 1970. 1 tab, 5 fig, 9 ref.

Descriptors: *Mass transfer, *Heat transfer, *Boundary layers, Air-water interfaces, Evaporation, Energy transfer, Convection, Reynolds number, Laminar flow, Turbulent flow, Turbulence.
Identifiers: Mass transfer theory, Heat transfer theory.

The linear stability of the flat plate boundary layer with surface blowing and suction is investigated by the application of numerical techniques. Complete neutral stability curves, critical Reynolds numbers and wave numbers, and other stability characteristics are determined for a wide range of surface mass transfer intensities. The critical Reynolds number, based on the displacement thickness, is found to vary from 59 to 32500 between the extreme limits of blowing and suction that are investigated. Comparisons are made between the present results and available linear stability information for boundary layers with surface mass transfer and with free-stream pressure gradients. The universal stability bound of Joseph is evaluated and compared with the corresponding numerically exact neutral stability curve. (Novotny-Vanderbilt)
W71-00658

ACTUAL EVAPOTRANSPIRATION AS DETERMINED FROM SOIL-WATER AND CANOPY CHARACTERISTICS AND POTENTIAL EVAPOTRANSPIRATION,
Wisconsin Univ., Madison. Dept. of Soil.
C. B. Tanner, and W. R. Gardner.
Available from NTIS as PB-193 149, $3.00 in paper copy, $0.95 in microfiche. Progress Report, June 1970. 65 p. ESSA Grant E-287-68 (G).
Identifiers: *Evapotranspiration, Predictions, *Plants (Botany), Evapotranspiration, *Soils, Plant tissue, Moisture, Site selection, Water, Vegetables, Energy, Seeds, Atmospheric temperature, Heat flux, Production, Agriculture, Irrigation systems, Stress (Physiology), Plant canopy, Onion plants, Heat budget.

Transpiration and evaporation from a sparsely populated onion field were computed separately from measured evapotranspiration, potential evaporation, stomatal resistances and leaf area indices. Transpiration also was calculated independently from measured stomatal resistance, air vapor pressure, plant-temperature and wind. Daily transpiration estimates found by these two methods agree within 5 percent. The transpiration was only about 25 percent of total evapotranspiration. This field, which was at 1/3-normal population, would transpire at proportionately greater rate if population were increased to normal; however, measurements show that soil evaporation decreases so that evapotranspiration would increase only about 15 percent. The portion of transpiration accounted for by each plant part was 3 percent for umbels, 42 percent for leaves and 55 percent for scapes.
W71-00818

EVAPORATION OF GROUNDWATER FROM COASTAL PLAYAS (SABKHAH) IN THE ARABIAN GULF,
Raikes and Partners, Rome (Italy).
J. G. Pike.
Journal of Hydrology, Vol 11, No 1, p 79-88, July 1970. 10 p, 2 fig, 3 tab, 3 ref.

Descriptors: *Evaporation, *Brines, *Playas, *Deserts, *Groundwater movement, Saline water systems, Water table, Water levels, Salt marshes, Coastal marshes, Evaporation pans.
Identifiers: Sabkhah, Arabian Gulf, Groundwater evaporation.

A sabkhah (plural: sibakh) is a coastal or inland saline mud flat or playa. They are commonly saturated with brine and are often salt encrusted. These sibakh occur in a belt, some 50 km in width, along the southern coast of the Arabian Gulf, extending from Kuwait to the Gulf States. During and after infrequent winter rainfall, these areas may sometimes flood for short periods. Much of the ponded water is lost to evaporation. Many sibakh have shallow water tables at depths of between 0.5 and 1.0 m, and show very little variation with time. A regional groundwater study of the eastern coastal belt of The Gulf suggests that the sibakh complex is either an evaporation sink for rising groundwater or that their water tables are perched. Net radiation, air temperature, vapor pressure, both dry and wet bulb temperatures, surface temperature, and windspeed records were collected. These data were then used to calculate the energy balance. Evaporation is taking place at a constant proportion of the energy income and from a constant depth to water table. Evaporation of groundwater from these sibakh is large and important in an area of limited water resources. (Knapp-USGS)
W71-00865

THE EFFECT OF NITROGEN SUPPLY ON TRANSPIRATION AND STOMATAL BEHAVIOUR OF BEANS (PHASEOLUS VULGARIS L.),
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
Daniel Shimshi.
New Phytologist, Vol 69, No 2, p 405-412, April 1970. 1 fig, 2 tab, 8 ref.

Descriptors: *Nitrogen, *Transpiration control, *Soil-water-plant relationships, *Stomata, *Moisture deficit, Leaves, Beans, Laboratory tests, Soil moisture, Plant physiology, Arid lands, Wilting point, Deserts, Moisture stress.
Identifiers: *Nitrogen deficit, Primary leaves, Trifoliate leaves, Desert soils, Seedlings, Negev Desert.

Arid lands are generally characterized by low soil N levels. Potted bean seedlings were grown and maintained in low-N Negev Desert soil and half were fertilized with N. The N-supplied plants exhibited normal leaf habits while only the primary leaves of the N-deficient leaves were green. With high soil moisture (14-20 percent) transpiration rates were highest in N-supplied plants, but on approaching the wilting point (7-10 percent) they dropped below the N-deficient plants. The stomata appeared closed, but coating with vapor-impervious compounds revealed they were open but below microscopic resolution and could be experimentally induced to much greater apertures. Apparently moisture stress occurs even at 17-20 percent soil moisture. When stomata were fully open, apertures were smaller in N-deficient plants but transpiration rates were comparable in all plants at higher levels of plant hydration. It was tentatively concluded that: (1) N-deficient plants cannot achieve normal stomatal openings and (2) The degree of leaf hydration probably effects some control on transpiration rates independently of stomatal control. (Casey-Arizona)
W71-00956

THE EFFECT OF NITROGEN SUPPLY ON SOME INDICES OF PLANT-WATER RELATIONS OF BEANS (PHASEOLUS VULGARIS L.),
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
Daniel Shimshi.
New Phytologist, Vol 69, No 2, p 413-424, April 1970. 3 fig, 2 tab, 21 ref.

Descriptors: *Nitrogen, *Transpiration control, *Soil-water-plant relationships, *Stomata, *Moisture deficit, Laboratory tests, Beans, Leaves, Chlorophyll, Electrolytes, Plant physiology, Soil moisture, Wilting.
Identifiers: *Nitrogen deficiency, Primary leaves, Trifoliate leaves, Sap solutes, Seedlings, Sap, Sugar, Desert soils.

In N-supplied single bean seedling leaves chlorophyll content was high and stomatal apertures were wide open while corresponding values for N-deficient leaves were 50 percent or less. A high soil moistures N-supplied trifoliate transpiration rate leaf values were higher than primary leaf values but dropped faster with decreasing soil moisture. In N-deficient plants the situation was reversed and both types of leaf had lower values than N-supplied plants. The differences were ascribable to 3 interacting factors: (1) Soil moisture (2) Leaf age and (3) N-status. Apparently stomata in N-deficient leaves fail to close as tightly as those of N-supplied leaves, accounting for their higher transpiration rates in drier soils. Below 9 percent soil moisture, N-supplied plants exhibited clear wilting symptoms never seen in N-deficient plants. N-supplied plants had consistently higher electrolyte and sap sugar levels in all ranges of soil moisture. Apparently N-deficiency inhibits sap sugar content response to moisture stress onset. Various theories concerning the mechanisms of these effects are discussed and it is concluded that the plant's abilities to regulate stomatal opening and sap-solute concentrations are affected by N deficiency. (Casey-Arizona)
W71-00957

SNOW COVER EVAPORATION IN THE SEMIDESERT ZONE OF KAZAKHSTAN,
S. P. Rylov.

Translation from Trudy KazNIGMI, No 32, p 64-77, 1969. Soviet Hydrology: Selected Papers, Issue No 3, p 258-270, 1969. 13 p, 3 fig, 8 tab, 29 ref.

Descriptors: *Evaporation, *Snow cover, *Foreign projects, Runoff, Vapor pressure, Snowmelt, Soil moisture, Statistical methods, Correlation analysis, Precipitation (Atmospheric), Meteorological data, Air temperature, Humidity, Hydrology, Wind velocity, Topography.
Identifiers: *Semidesert zone, *Kazakhstan (USSR).

Observational data of the West Kazakhstan runoff station for a 14-year period (1952-65) were used to estimate snow evaporation in winter and spring in the semidesert zone of Kazakhstan U.S.S.R. Two types of relationships were constructed on the basis of measurements of snow evaporation and average meteorological elements (temperature, absolute humidity, and vapor pressure deficit). The first of these included the relationship between snow evaporation and air temperature and absolute humidity, and the second was constructed from the relationship between snow evaporation and the vapor pressure deficit. Results indicate the following: (1) the rate of evaporation from snow is 0.09-0.12 in winter and 0.40-0.60 mm/day in spring; (2) the computed evaporation from snow in the December-March period ranges from 15 mm in the north to 25-30mm in the south; (3) the losses in snow storage through evaporation are 15% in winter, and 5% for the nonreduced evaporation depth and 18% for the reduced evaporation depth during the snow melting period; (4) verification of the existing methods of computing evaporation from snow in the semidesert zone of Kazakhstan showed that the most accurate and simple method of computing it is that based on the vapor pressure deficit. (Woodard-USGS)
W71-01093

E. Streamflow and Runoff

PREDICTING AND MAPPING THE AVERAGE HYDROLOGIC RESPONSE FOR THE EASTERN UNITED STATES,
Georgia Univ., Athens.
For primary bibliographic entry see Field 02A.
W71-00551

WATER RESOURCES INVESTIGATIONS IN THE SUSQUEHANNA RIVER BASIN,
Geological Survey, Harrisburg, Pa.
J. V. Page, and P. R. Seaber.
Pennsylvania Department of Forests and Waters Technical Bulletin No 2, 1970. 1 sheet, 2 tab, 1 map.

Descriptors: Water resources, *Surface waters, Groundwaters, *Sedimentation, Water quality, Hydrology, Acidity, Geology, Aquifers, Pennsylvania.
Identifiers: *Hydrologic atlas, *Susquehanna River basin.

Active areal projects in the Susquehanna River basin operated by the U.S. Geological Survey (WRD) in cooperation with other agencies are shown on this hydrologic atlas as follows: (a) Hydrology and sedimentation of the Corey Creek and Elk Run watersheds; (b) surface-water quality of the West Branch Susquehanna River basin; (c) acidity of Beech Creek; (d) surface-water quality of the West Branch Susquehanna basin in the vicinity of Curwensville, Pa.; (e) water quality of the Susquehanna River at Danville, Pa.; (f) Hydrology and sedimentation of the Bixler Run watershed; (g) water resources of the Swatara Creek basin; (h) geology and hydrology of the Marcellus shale in central Dauphin County, Pa.; (i) variations in the chemical character of the Susquehanna River at Harrisburg, Pa.; (j) hydrology of limestones in the Lebanon Valley; (k) hydrology of the New Oxford Formation in Adams and York Counties, Pa.; (l) hydrology of the New Oxford Formation in Lancaster County, Pa.; (m) hydrology of the Carbonate Rocks of the Lancaster quadrangle, Lancaster County, Pa.; (n) hydrology of the metamorphic and igneous rocks of Central Chester County, Pa.; and (o) reconnaissance of the Chemical Quality of Maryland Streams. Listed are 150 selected reports devoted exclusively to or containing data on water in the Susquehanna River basin. (Woodard-USGS)
W71-00564

WATER RESOURCES INVESTIGATIONS IN THE UPPER OHIO RIVER BASIN,
Geological Survey, Harrisburg, Pa.
C. J. Rossow, and M. B. Coll, Jr.
Pennsylvania Department of Forests and Waters Technical Bulletin No 1, 1970. 1 sheet, 2 tab, 1 map.

Descriptors: Water resources, *Groundwater, *Surface waters, Water quality, Geology, Aquifers, Hydrology, Pennsylvania.
Identifiers: *Hydrologic atlas, *Upper Ohio River basin, Acid mine drainage.

Active areal projects in the Upper Ohio River basin operated by the U. S. Geological Survey (WRD) largely in cooperation with other agencies, are shown on this hydrologic atlas as follows: (a) Ground-water resources, Allegheny River basin and part of the Lake Erie basin, New York; (b) surface-water resources of the Allegheny River basin and part of the Lake Erie basin, New York; (c) chemical quality of streams, Allegheny River basin, New York; (d) geology and ground-water resources of western Crawford County; (e) geology and ground-water resources of the Shenango and Stoneboro quadrangles; (f) investigation of principal aquifers in northeastern Ohio; and (g) Roaring Creek-Grassy Run acid mine drainage study. Listed are 255 selected reports regarding water-resources investigations or containing data on water in the Ohio River basin and 45 selected references on hydrology. (Woodard-USGS)
W71-00566

RECESSION AND THE BASEFLOW PROBLEM,
Imperial Coll. of Science and Technology, London (England).
F. Victor Appleby.
Water Resources Research, Vol 6, No 5, p 1398-1403, October 1970. 6 p, 1 fig, 22 ref.

Descriptors: *Recession curves, *Base flow, *Reviews, Bibliographies, Surface-groundwater relationships, Discharge (Water), Recharge, Rainfall-runoff relationships, Streamflow, Hydrograph analysis.
Identifiers: Base flow calculation.

Baseflow is discussed as a hydrograph component, with special reference to a 1968 review paper, 'Base-Flow Recession.' Additional references with particular emphasis on the baseflow problem are given. A three parameter baseflow partition functional is shown to give substance to the concept of 'group persistence' and to suggest an underlying mechanism to the Hurst statistical phenomenon. (Knapp-USGS)
W71-00577

MEASURING FLOW THROUGH CREST GATES,
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 07B.
W71-00582

PARTIAL AREA CONTRIBUTIONS TO STORM RUNOFF IN A SMALL NEW ENGLAND WATERSHED,
Agricultural Research Service, Danville, Vt.
For primary bibliographic entry see Field 02A.
W71-00588

MODELING THE EFFECT OF LAND USE MODIFICATIONS ON RUNOFF,
Agricultural Research Service, Brookings, S. Dak.; and Water Resources Board, Reading (England).
For primary bibliographic entry see Field 04C.
W71-00589

NONLINEAR TIME VARYING MODEL OF RAINFALL-RUNOFF RELATION,
Pittsburgh Univ., Pa.
For primary bibliographic entry see Field 02A.
W71-00590

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS, PART III -- THE RAY CATCHMENT AT GRENDON UNDERWOOD,
Institute of Hydrology, Wallingford (England).
A. N. Mandeville, P. E. O'Connell, J. V. Sutcliffe, and J. E. Nash.
Journal of Hydrology, Vol 11, No 2, p 109-128, August 1970. 20 p, 9 fig, 2 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Streamflow forecasting, Routing, Soil moisture, Antecedent precipitation, Hydrologic budget, Water balance, Statistical models.
Identifiers: Ray watershed (England).

Methods of modeling the runoff process on the Ray catchment, England, are described. These depend on soil moisture accounting and simple descriptions of the generation of runoff and of routing. It is found possible, with simple models, to account for about 90 percent of the initial variance of runoff volumes and about 75 percent of the initial variance of the discharge rate. (Knapp-USGS)
W71-00591

THE MEASUREMENT OF THE EFFECTS OF BUILDING CONSTRUCTION ON DRAINAGE BASIN DYNAMICS,
Exeter Univ. (England).
For primary bibliographic entry see Field 04C.
W71-00592

THE CENTRAL AUSTRALIAN STREAM FLOODS OF FEBRUARY-MARCH 1967,
Adelaide Univ. (Australia). Dept. of Geology.
George E. Williams.
Journal of Hydrology, Vol 11, No 2, p 185-200, August 1970. 16 p, 6 fig, 4 tab, 11 ref.

Descriptors: *Floods, *Deserts, *Arid lands, *Historic flood, Stage-discharge relations, Hydrologic data, Data collections, Sediment transport, Sedimentary structures, Flood damages, Turbulent flow, Critical flow, Velocity.
Identifiers: *Australia.

Between Feb. 5 and Mar. 8, 1967, central Australia received some of its heaviest rains on record. Derived from three separate southward intrusions of monsoonal weather, the rains gave total gagings of 120-350 mm, with some stations receiving overnight falls of over 150 mm. The ensuing floods were the most devastating in the western Lake Eyre basin in living memory. Accurate hydrological data are available only for the Todd and Finke rivers. During the 1967 floods the Todd attained a maximum gage height of 2.17 m and a mean velocity of 1.95 m/sec; the Finke, a maximum gage height of 6.95 m. Other major streams flooded to depths of 3-5 m and locally spread to widths of several kilometers. On March 15, floodwaters were observed entering Lake Eyre by way of the Macumba and the Neales. Finke waters did not reach Lake Eyre, being absorbed by the sands of the Simpson Desert. Large-scale ripples (dunes) were preserved on most sand-bed channels at the recession of the floods, indicating that subcritical flow prevailed for most streams. By estimating the Froude number and the Darcy-Weisbach resistance coefficient for large-scale ripples, mean stream velocities of about 0.8-2.8 m/sec have been calculated for such chan-

nels. In contrast, flat-bedded sand with parting lineation was deposited in the middle reach of the Finke. It is estimate d that there the Finke attained a mean velocity of about 3 m/sec and a peak discharge of about 1200 cu m/sec. (Knapp-USGS)
W71-00596

RIVER DISCHARGE MEASUREMENT BY THE RISING FLOAT TECHNIQUE,
Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
For primary bibliographic entry see Field 07B.
W71-00597

THE ROLE OF MIXING IN STRATIFIED FLOWS - AN ANNOTATED BIBLIOGRAPHY,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
N. Hayakawa, and F. R. Schiebe.
FWQA Grant. St. Anthony Falls Hydraulic Laboratory, No IM-93, October, 1968.

Descriptors: *Abstracts, *Thermal stratification, *Bibliographies, Interfaces, Hydrodynamics.

Concurrently with a research program concerned with mixing at the interface of a three-dimensional thermally stratified flow, a literature search was conducted. Abstracts of 163 papers dealing with the hydrodynamics of stratified flow were assembled in alphabetical order according to authors. The bibliography is not intended to be complete. The material was compiled in 1966 and contains material published that year and published prior to 1966. (Osborne-Vanderbilt)
W71-00650

STREAMFLOW SYNTHESIS FOR UNGAGED RIVER,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Tech Paper No 5, The Hydrologic Engineering Center, Corps of Engineers, US Army, Sept-Oct 1967. 14 p, 6 tab, 4 ref.

Descriptors: *Mathematical models, *Simulation analysis, *Streamflow, *Monthly.
Identifiers: Model coefficients.

A mathematical model for simulating monthly streamflow, developed by the Hydrologic Engineering Center of the Corps of Engineers was described Model coefficients for each of the 12 calendar months and number 48 for a single location. For the purpose of deriving a monthly streamflow model for ungaged locations, these coefficients were combined into a small number of generalized coefficients, which can feasibly be related to drainage basin characteristics. Generalized coefficients for simulating monthly streamflows were developed with the requirement that important characteristics of flows generated using the generalized coefficients compared reasonably with those characteristics of recorded data at long-record stations throughout the United States. Means of establishing generalized model coefficients and generating hypothetical streamflows for ungaged locations were described. The generalized model required 4 statistics for use at a single station. These were indexes of wet-season average flow, dry season average flow, flow variation from year to year, and flow persistence from month to month. The statistics represented the important characteristics of streamflow and were designed so that any amount and type of information could be used in their estimation. (Kriss-Cornell)
W71-00709

SIMULATION OF DAILY STREAMFLOW,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Tech Paper No 6, The Hydrologic Engineering Center, Corps of Engineers, US Army. 13 p, 5 tab, 4 ref.

Descriptors: *Simulation analysis, *Mathematical modes, *Computer programs, *Markov processes, *Streamflow, Monthly, Stations.

Generation of daily streamflow for a location where daily flow records existed and where monthly total flows for the periods of generation were given was accomplished by two elaborate computer programs usable in high-speed computers. The model described was based on adequate representation of daily streamflow variations at the 7 selected stations listed. Data used for tests of the model were limited to the 7 stations. The procedure was based on generation of monthly streamflows and subsequent allocation of the monthly total amounts to each day. The monthly streamflow generator used was developed in the Hydrologic Engineering Center of the Corps of Engineers and for a single station it consisted of a simple Markov chain, with each flow consisting of a random component and a component correlated with the preceding month's flow. The mathematical model used for daily streamflow simulation consisted of a second order Markov chain, using standardized variates. Results for the 7 stations used were summarized. A summary of the procedure and a test of the over-all results was given. (Kriss-Cornell)
W71-00715

THE MATHEMATICAL SIMULATION OF THE HYDROLOGY OF SMALL WATERSHEDS,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
L. F. Huggins, and E. J. Monke.
Purdue University Water Resources Research Center, Lafayette, Indiana, Tech Rep No 1, Aug 1966. 130 p, 19 fig, 5 tab, 3 append, 52 ref.

Descriptors: *Mathematical models, *Hydrology, *Digital computers, *Hydrographs, *Simulation analysis, Watershed management, Runoff.

A mathematical model which integrated the relationships for various hydrologic components of runoff at all points in a watershed to obtain the runoff hydrograph for a complete area was proposed. The procedure consisted of the development of relationships describing the runoff dynamics for very small elemental areas or points within the watershed. Quantitative relationships were suggested for five of the basic hydrologic components which described the runoff processes: interception, infiltration, depression storage or surface retention, surface detention and surface runoff. A general purpose digital computer program, written in Fortran IV was developed to evaluate the resulting mathematical watershed model. The ability of the proposed watershed model to simulate observed runoff hydrographs from small (two acre) watersheds was investigated for several storm events. The model was capable of simulating complex storm events very satisfactorily. A comparison between the runoff hydrograph predicted for each storm event by the synthetic hydrograph analysis and the proposed model was made. The sensitivity of the predicted hydrographs of selected storm event to changes in the values of the assumed initial parameters was reported. (Kriss-Cornell)
W71-00720

RUNOFF ROUTING THROUGH STEEP NATURAL CHANNELS,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 08B.
W71-00842

GEOMETRIC AND FRICTIONAL EFFECTS OF SUDDEN RELEASES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-00843

THROUGHFLOW ON HILLSLOPES AND ITS RELATION TO THE STREAM HYDROGRAPH,
Bristol Univ. (England).
For primary bibliographic entry see Field 02G.
W71-00858

AN UNCONVENTIONAL APPROACH TO FLOOD FREQUENCY ANALYSIS,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02A.
W71-00861

ON THE COMPUTER EVALUATION OF THIESSEN WEIGHTS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02A.
W71-00864

SOME ASPECTS OF THE AVAILABILITY OF WATER FROM THE EVERGLADES TO THE EVERGLADES NATIONAL PARK, FLORIDA,
Geological Survey, Tallahassee, Fla.
J. H. Hartwell.
Geological Survey Open-file Report 70007, September 1970. 36 p, 10 fig, 2 tab, 7 ref.

Descriptors: *Florida, *Water sources, *Swamp, Surface drainage, *Rainfall-runoff relationship, *Depth-area-curves, Surface waters, Streamflow, Canals, Levees, Stream gages, Flow rate, Discharge measurement, Flow characteristic, Water management (Applied), Discharge (Water)
Identifiers: *Everglades, *Everglades National Park (Florida).

Hydrologic information was evaluated to determine the source of water in south Florida that flowed from the north into Everglades National Park. In particular, consideration was given to overland flow of water to the park. A comparison was made of discharges at several locations for two 12-year periods, 1940-51 and 1952-63. The first period was prior to the construction of water control works for the Central and Southern Florida Project. The second period covered the time during which control works were progressively being built. Discharge from Lake Okeechobee to the Everglades was 5.4 million acre-feet for the period 1940-51 and 1.5 million acre-feet during 1952-63. In spite of the reduction in flow from Lake Okeechobee to the Everglades in the second period, the flow to the Everglades National Park into the Shark River Slough was 2.7 million acre-feet greater in the second period than during the first period. An increase in rainfall on Conservation No. 3 in the period 1952-63 probably contributed significantly to the increased discharge to Shark River Slough, but some of the increase in discharge apparently resulted from new control works of the Central and Southern Florida Project, which reduced flow to the sea through the coastal canals. Related maps, graphs, and tables of data are included. (Woodard-USGS)
W71-00880

LOW-FLOW FREQUENCIES OF ILLINOIS STREAMS,
Geological Survey, Washington, DC.
Oscar G. Lara.
Illinois Department Public Works and Building Division of Waterways Report, 1970. 317 p, 11 fig, 6 tab, 11 ref.

Descriptors: *Low flow, *Frequency, *Streamflow, *Illinois, Data collections, Hydrologic data, Frequency analysis, Statistical methods, Streamflow forecasting, Duration curves.
Identifiers: Low-flow frequency.

This report contains low-flow data and regionalized low-flow frequency curves for all areas in Illinois where at least five years of record (through 1965) have been collected. Minimum average flows for periods of 1, 7, 15, 30, 60, 120, and 183 days are tabulated for the benefit of those who are

erested in the amount of flow available in the tream with minor or no storage. Data for 12, 24, nd 60 months are also included in the tables for hose concerned with the minimum expected in- low into large impounding reservoirs. Six separate egionalized frequency curves for each station have een fitted on the plotted data. These curves evalu- te the minimum average flow expected in periods f 7, 15, 30, 60, 120, and 183 days, respectively. A echnique is derived to serve as a guide in fitting requency curves to observed data on a regional- ed basis, and for the purpose of extrapolating hort-term records. This technique is based on rela- ons empirically developed between low-flow and ow-duration parameters. (Woodard-USGS)
/71-00884

/ATER RESOURCES OF THE CENTRAL NEW ORK REGION,
eological Survey, Albany, N.Y.
/illiam G. Weist, Jr., and G. L. Giese.
ew York Water Resources Commission Bulletin 4, 1969. 58 p, 21 fig, 2 plate, 3 tab, 22 ref.

escriptors: *Water resources, *Surface waters, Groundwater, New York, Hydrologic cycle, reamflow, Flow rates, Geology, Geologic forma- ons, Aquifers, Bedrock, Water quality, Water sources development, Regional flood, Ground- ater recharge, Irrigation, Water pollution.
entifiers: Water-related problems, Streamflow xtremes, Available water supply.

his report summarizes the available data on the ater resources of the Central New York Region hich includes Cayuga, Cortland, Madison, Onon- ga, and Oswego Counties--an area of 3,622 uare miles centering around Syracuse. The 0,000 people living in the region use about 310 gd (million gallons per day) of water for domestic d industrial purposes. About 90% of this water esently comes from surface-water sources. The gion includes parts of four major drainage basins: e Mohawk River, the Oswego River, the squehanna River, and the Lake Ontario plains. reamflow in the region is highly variable both om time to time, and from place to place. roundwater in the region occurs in both con- lidated deposits (bedrock) and unconsolidated posits (sand, gravel, etc.). The bedrock can be vided into seven units on the basis of similarity of hology and hydrologic porperties. These units e, in ascending order, lower shale, sandstone, ndstone-shale, dolomite, middle shale, limestone, d upper shale. The best sources of groundwater the region are the unconsolidated deposits of nd and gravel in the major valleys. Maps, graphs, d tables pertinent to the study are included. Woodard-USGS)
71-00894

VER TIME-OF-TRAVEL AS DETERMINED Y FLUORESCENT DYE MEASUREMENTS ND KINEMATIC WAVE PROCEDURES,
yoming Univ., Laramie. Dept. of Engineering.
erald R. Zimmerman.
S. Thesis, Wyoming University Graduate hool, August 1970. 104 p, 43 fig, 9 tab, 31 ref, pend. OWRR Project A-001-WYO (31).

escriptors: *Streamflow, *Flow rates, *Time, Dye releases, Tracers, Fluorescence, Channel orphology, Discharge measurements, Low flow, e, Maps, Wyoming.
entifiers: *Time-of-travel, *Laramie River /yo), High flow, Ice conditions, Curves.

ree time-of-travel measurements using a orescent dye as a tracer were conducted on a 8-mile reach of the Laramie River in the vicinity Laramie, Wyoming, and one measurement on a 5-mile reach of Nash Fork in the Snowy Range ountains. For the Laramie River the studies were ring relatively high flow, low flow, and ice condi- ns. One of the unique portions of the study was at it was conducted under ice conditions. A arch of the lieterature failed to find a previous study of travel time with ice cover. Because of the added friction at the surface, the time-of-travel under ice was longer than for open water even for a larger discharge. It was determined that the peak travel time could be reproduced by an overlapped dye cloud while the centroid travel times were not consistant. Because of this, the peak travel times were used to define the mean velocity of the river in a test reach. The results from the time-of-travel studies were compared with mathematically routed dye clouds using the continuity and momentum equations. These comparisons were in good agreement. (Woodard-USGS)
W71-00904

AN APPROACH TO THE SELECTION OF A STREAMFLOW BASE PERIOD,
Wyoming Univ., Laramie. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-00905

WATER RESOURCES OF THE CHAMPLAIN-UPPER HUDSON BASINS IN NEW YORK STATE,
Geological Survey, Albany, N.Y.
G. L. Giese, and W. A. Hobbs, Jr.
New York State Water Resources Commission and Office of Planning Coordination Report, 1970. 153 p, 31 fig, 2 plate, 6 tab, 23 ref, 8 append.

Descriptors: *Water resources, New York, Surface waters, Groundwater, Water quality, Water resources development, Hudson River, Streamflow, Aquifers, Water yield, Water supply, Runoff, Hydrogeology, Data collections, Hydrologic data, Water wells.
Identifiers: Lake Champlain (NY), Hudson River basin (NY).

This report describes the surface- and groundwater resources of the Lake Champlain-Upper Hudson region--a 6,108-square mile area in northeastern New York State. The region is water rich, having an average yearly precipitation of 38 inches. Major rivers include the Saranac, Ausable, Bouquet, Schroon, Sacandaga, and Hudson Rivers. Runoff in streams averages about 1.8 cubic feet per second per square mile but ranges from less than 1.0 to more than 2.0. The valley-fill deposit of the Glens Falls area is the largest groundwater aquifer in the study area. Yields from individual wells in this area average 67 gpm but are as much as 400 gpm from properly constructed wells. The bedrock is most productive where it constitutes an artesian system in the Plattsburgh area. Wells in this system yield an average of 35 gpm and may yield as much as 200 gpm. The chemical quality of the waters is good to excellent. Dissolved solids content, even of the groundwaters, rarely exceeds 500 ppm. In large sections of the Adirondack Mountains underlain by crystalline rocks, dissolved solids content of the groundwaters is less than 100 ppm. The amount of dissolved material in surface waters is even less. High hardness and alkalinity are sometimes found in eastern and northern parts of the area. (Knapp-USGS)
W71-00906

MEANDER GEOMETRY ARISING FROM VARYING FLOWS,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 02J.
W71-01061

THE PROGRESS OF HYDROLOGY: VOL 1--NEW DEVELOPMENTS IN HYDROLOGY.
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02A.
W71-01067

FITZGERALD V FORTIER (LIABILITY FOR OBSTRUCTION OF WATERCOURSES).

198 NE 167-170 (Mass 1935).

Descriptors: *Massachusetts, *Watercourses (Legal), *Obstruction to flow, *Surface drainage, Surface runoff, Culverts, Legal aspects, Judicial decisions, Drainage, Natural flow, Diversion, Channels, Meanders, Beds, Banks, Lakes, Springs, Landfills, Damages.

Plaintiff brought suit against defendant for injunctive relief and damages for defendant's obstruction of a natural watercourse which caused the backing up of water onto plaintiff's land. Plaintiff contended that defendant had filled in his land so that the natural flow of the alleged watercourse was blocked. The prime question was whether the stream of water diverted by defendant onto plaintiff's land was from a natural watercourse or merely surface drainage which ran from defendant's land over the land of plaintiff. The trial court ruled for plaintiff, and the Supreme Judicial Court of Massachusetts affirmed. The court held that the evidence supported the trial court's finding that there was a natural watercourse. Such evidence showed the existence of a natural channel with beds and banks, even though water did not flow on a continual basis. (Duss-Florida)
W71-01082

RECENT DEVELOPMENTS IN MEASURING TECHNIQUES FOR FLOW IN OPEN CHANNELS,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 07B.
W71-01085

STATISTICAL SUMMARIES OF MICHIGAN STREAMFLOW DATA,
Geological Survey, Lansing, Mich.
R. L. Knutilla.
Geological Survey Open-file report, June 1970. 283 p, 5 fig, 15 ref.

Descriptors: *Streamflow, Michigan, *Hydrologic data, Data collections, Duration curves, Low flow, Peak discharge, Statistics, Hydrographs, Streamflow forecasting.
Identifiers: Streamflow data (Mich.).

Michigan gaging station data of 10 or more years of record and which were not seriously affected by regulation are tabulated. Selected summaries--summaries used most frequently by consultants and water managers--are compiled for this report. For each gaging station the following data are provided: duration table of daily discharge; lowest mean discharge; highest mean discharge; monthly mean discharges; annual mean discharge; and annual peak discharges. For stations having 19 or more years of record duration hydrographs are shown. (Knapp-USGS)
W71-01088

CAUSES OF LONG-PERIOD STREAMFLOW FLUCTUATIONS,
For primary bibliographic entry see Field 02A.
W71-01091

APPROXIMATE ESTIMATE OF THE POSSIBLE UTILIZATION OF THE WATER RESOURCES OF KAZAKHSTAN,
For primary bibliographic entry see Field 02A.
W71-01092

A HYDROLOGIC INVENTORY SYSTEM,
State Univ. of New York, Binghamton. Dept. of Geology.
For primary bibliographic entry see Field 07A.
W71-01097

2F. Groundwater

LAND SUBSIDENCE RELATED TO DECLINE OF ARTESIAN HEAD AT BATON ROUGE, LOWER MISSISSIPPI VALLEY, U. S. A.,
Geological Survey, Washington, D. C.
G. H. Davis, and J. R. Rollo.
French resume. In: Land Subsidence, Proceedings Tokyo Symposium - International Association of Scientific Hydrology and UNESCO, September 1969, Vol 1 of 2 Vol, p 174-184, 1970. 11 p, 8 fig, 15 ref.

Descriptors: *Subsidence, *Withdrawal, *Artesian wells, *Louisiana, *Mississippi River Basin, Water levels, Water level fluctuations, Potentiometric level, Confined water, Water utilization, Discharge (Water).
Identifiers: Baton Rouge (La).

Comparison of precise levelling in the Baton Rouge area of the Lower Mississippi Valley indicates as much as 30 cm of subsidence of the land surface during the period 1900-1965. Maximum subsidence is centered in the Baton Rouge industrial district, the area of greatest withdrawals from wells and maximum decline of artesian head. Lines of equal subsidence for the period 1934 to 1965 show a bowl-shaped depression slightly elongated east-west; the 5-cm subsidence line encloses an area of about 250 sq mi. The areal distribution of subsidence corresponds closely with distribution of decline in head in the confined aquifer system. Increases in rate of head decline in heavily pumped zones are reflected in accelerating subsidence. Presumably head decline in the multiple aquifier system of the Baton Rouge area has caused compaction of fine-grained sediments interbedded with and separating the beds of water-bearing sand. Average head decline in the aquifer system in the area of maximum subsidence approximates 200 feet since pumping of confined water began about 1890. The ratio of subsidence to head decline is about 0.5 foot of subsidence for each 100 feet of head decline. Subsidence can be expected to continue with continuing head decline. (Knapp-USGS)
W71-00563

QUANTITATIVE MAPPING OF SALINITY, VOLUME, AND YIELD OF SALINE AQUIFERS USING BOREHOLE GEOPHYSICAL LOGS,
Geological Survey, St. Louis, Mo.; and Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C.
W71-00571

NONUNIQUENESS OF STEADY STATE FINGERING SOLUTIONS IN POROUS MEDIA,
Purdue Univ., Lafayette, Ind.
James E. Varnon, and Robert A. Greenkorn.
Water Resources Research, Vol 6, No 5, p 1411-1414, October 1970. 4 p, 8 ref. ACS-PRF Grant 1797-A2, A6.

Descriptors: *Mathematical studies, *Flow, *Porous media, *Interfaces, Oil-water interfaces, Surfaces, Equations, Boundary processes.
Identifiers: Multiphase flow, Fingering.

Steady state solutions for single viscous fingers in 2-phase flow in porous media are nonunique because the position of the interfacial boundary is not specified. Expanding the steady state problem to include an arbitrary number of fingers does not make the solution unique. The initial value problem however does have a unique solution. This suggests that it is futile to look for additional conservation equations in the hope of making the steady state solutions unique. (Knapp-USGS)
W71-00580

FLUID TRAVEL TIME BETWEEN A RECHARGING AND DISCHARGING WELL PAIR IN AN AQUIFER HAVING A UNIFORM REGIONAL FLOW FIELD,
Geological Survey, Denver, Colo. Water Resources Div.
D. B. Grove, W. A. Beetem, and F. B. Sower.
Water Resources Research, Vol 6, No 5, p 1404-1410, October 1970. 7 p, 5 fig, 1 ref.

Descriptors: *Groundwater movement, *Confined water, *Velocity, *Equations, *Computer programs, Mathematical studies, Aquifers, Artesian wells, Injection wells, Tracers, Path of pollutants, Recharge, Discharge (Water), Flow, Steady flow.
Identifiers: Travel time.

Equations describing steady state flow between a recharging-discharging pair of wells in a confined aquifer which has a uniform regional flow field are used in a computer solution for the travel time of fluid between the wells. The time required for a contaminant or a tracer to travel from the recharging well to the discharging well, and the temporal variation in concentration of the contaminant can be read directly from generalized plots of the computer solution. (Knapp-USGS)
W71-00581

VARIATIONAL PRINCIPLES FOR CONFINED AND UNCONFINED FLOW OF GROUNDWATER,
California Univ., Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Water Resources Research, Vol 6, No 5, p 1376-1382, October 1970. 7 p, 4 fig, 21 ref.

Descriptors: *Groundwater movement, *Flow, *Confined water, *Percolating water, *Mathematical studies, Computers, Computer programs, Dispersion, Diffusion, Saturated flow, Unsaturated flow, Velocity, Darcys law, Capillary action, Steady flow, Unsteady flow.
Identifiers: Finite element techniques, Variational techniques.

Finite element techniques are being employed to an increasing degree in solving complicated groundwater flow problems, including problems with a free surface. These methods usually rely on the development of appropriate variational principles. This paper presents several such principles for both confined and unconfined flow. (Knapp-USGS)
W71-00583

A NEW CONDUCTIVITY METHOD FOR DETERMINING CONCENTRATIONS IN PARALLEL PLATE MODELS,
Guelph Univ. (Ontario).
For primary bibliographic entry see Field 07B.
W71-00593

THE EFFECT OF CONTACT POINTS ON SPECIFIC RETENTION OF RUBBLY ROCK PARTICLES,
Khartoum Univ. (Sudan). Dept. of Geology.
Ismail M. El Boushi.
Journal of Hydrology, Vol 11, No 2, p 159-168, August 1970. 10 p, 3 fig, 3 tab, 6 ref.

Descriptors: *Specific retention, *Capillary water, Hydraulic models, Laboratory tests, Porosity, Porous media, Groundwater, Soil water, Permeability, Specific yield, Water storage, Particle size, Gravels.
Identifiers: Water retention (Porous media).

Most of the water of retention of rubbly rock particles is held by contact points in the form of funicular or pendular water bodies. The contact of 38 mm spheres marks the point where the tendency to form funicular water bodies ends and the tendency to form pendular rings starts. Although the particle surface area for sizes below 38 mm is an important factor in controlling water of retention, water held at the contact points is of more importance. (Knapp-USGS)
W71-00594

FACTORS CONTROLLING THE LOCATION OF THE GROUNDWATER DIVIDE IN NORTHERN ISRAEL,
Israel Geological Survey, Jerusalem.
U. Kafri.
Journal of Hydrology, Vol 11, No 1, p 22-29, July 1970. 8 p, 4 fig, 1 tab, 18 ref.

Descriptors: *Groundwater movement, *Groundwater basins, *Hydrogeology, *Carbonate rocks, Recharge, Discharge (Water), Water levels, Water level fluctuations, Geohydrologic units, Water yield, Water resources development.
Identifiers: Israel.

The location and formation of the regional groundwater divide in the Cenomanian-Turonian carbonate aquifer of Galilee, which today is situated west of the structural axial region, is controlled by two factors: 1, the shifting of the ancient groundwater divide from the structural axis zone westward, due to tectonic movements and formation of new base levels since the Neogene; 2, facies changes within the carbonate aquifer and differences in permeability between its lower and upper subaquifers. As a result, an upconing of the water table may occur during the process of natural recharge, and thus, regional or local groundwater divides may be formed. (Knapp-USGS)
W71-00599

GROUNDWATER ATLAS OF NEBRASKA (REPRINTED JUNE 1969).
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 07C.
W71-00613

BIOLOGICAL ZONATION RELATED TO GROUNDWATER DISCHARGE ALONG THE SHORE OF BISCAYNE BAY, MIAMI, FLORIDA,
Geological Survey, Miami, Fla. Water Resources Div.
For primary bibliographic entry see Field 02L.
W71-00615

GEOLOGY AND GROUNDWATER RESOURCES OF NEW HANOVER COUNTY, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
George L. Bain.
North Carolina Division of Groundwater Bulletin No 17, April 1970. 79 p, 22 fig, 5 tab, 21 ref.

Descriptors: *Hydrogeology, *Aquifers, *Water resources development, *North Carolina, Groundwater, Water resources, Water quality, Water wells, Artesian wells, Water yield, Transmissivity, Withdrawal, Water supply, Water levels, Data collections, Hydrologic data.
Identifiers: New Hanover County (NC).

This report describes the groundwater resources of New Hanover County in southeastern North Carolina. The county is a part of the Atlantic Coastal Plain Province and occupies a peninsula between the Atlantic Ocean and the Cape Fear and Northeast Cape Fear Rivers. The climate is humid; the average annual precipitation is about 50 inches. Groundwater occurs in a system of slightly inclined formations underlying the Coastal Plain. Maximum thickness in New Hanover County is slightly more than 1,500 feet. Most of the formations are composed of unconsolidated sands and clays containing a few beds of limestone and calcareous sandstone. The volume of water stored in the Coastal Plain formations in New Hanover County is large; however, water in all but the shallow formations is too salty for most uses. Water of acceptable chemical quality for most purposes is available throughout the county, but a wide range in quality of water within the aquifers is common. The current withdrawal of groundwater is only a small part of the available supply. (Knapp-USGS)
W71-00635

ITIUM - A HYDROLOGIC TOOL,
ological Survey, Washington, D.C. Water sources Div.
r primary bibliographic entry see Field 07B.
71-00690

DROLOGY OF PROJECT GASBUGGY SITE, O ARRIBA COUNTY, NEW MEXICO,
ological Survey, Denver, Colo.
r primary bibliographic entry see Field 04B.
71-00810

ESHWATER BUBBLES: A POSSIBILITY R USING SALINE AQUIFERS TO STORE ATER,
ological Survey, Denver, Colo.
r primary bibliographic entry see Field 04B.
71-00836

UID MODEL STUDIES OF THE STORAGE FRESHWATER IN SALINE AQUIFERS,
isiana State Univ., Baton Rouge.
primary bibliographic entry see Field 04B.
1-00838

ORAGE OF NATURAL GAS IN SALINE UIFERS,
chigan Univ., Ann Arbor.
primary bibliographic entry see Field 04B.
1-00839

DUCING LAND SUBSIDENCE IN THE LMINGTON OIL FIELD BY USE OF SALINE TERS,
g Beach Dept. of Oil Properties, Calif.
primary bibliographic entry see Field 04B.
1-00840

PORT ON GEOPHYSICAL AND TELEVI-N EXPLORATIONS IN CITY OF JACKSON-LE WATER WELLS,
ological Survey, Tallahassee, Fla.
primary bibliographic entry see Field 04B.
1-00849

MPREHENSIVE PLANNING STUDY OF THE AND RIVER BASIN, MICHIGAN--APPEN-E.
ological Survey, Lansing, Mich.

dy made with funds administered by US Army ps of Engineers. Geological Survey Open-file ort, 1970. 76 p, 22 fig, 6 tab, 37 ref.

criptors: *Water resources, Michigan, oundwater, *Aquifers, Water resources elopment, Hydrologic data, Data collections, drogeology, Water quality, Water yield.
ntifiers: Grand River basin (Mich).

principal aquifers in the Grand River basin, higan include beds of sand and gravel of glacial in and bedrock formations of sandstone and estone. As these aquifers vary considerably in meability from one area to another, maximum yields range from less than 10 gpm to more 1000 gpm. Large yields generally can be ob-ed from wells adjacent to streams where the ifers are recharged by the streams. Most of the er obtained from wells is hard to very hard, and ch of it contains objectionable concentrations of . Most water can be made satisfactory for rly all uses with commonly-used water treat-t processes and equipment. Saline water is sent at depth throughout the basin, and in some lities, saline water is at relatively shallow depth. groundwater reservoirs, although extensively zed at the present, have considerable potential additional development. (Knapp-USGS)
1-00851

THROUGHFLOW ON HILLSLOPES AND ITS RELATION TO THE STREAM HYDROGRAPH,
Bristol Univ. (England).
For primary bibliographic entry see Field 02G.
W71-00858

USE OF SEISMIC REFRACTION MEASUREMENTS FOR GROUND WATER PROSPECTING,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. Galfi, and M. Palos.
Bulletin International Association of Scientific Hydrology, Vol 15, No 3, p 41-46, September 1970. 6 p, 6 fig.

Descriptors: *Groundwater, *Water table, *Seismic studies, *Exploration, Locating, Seismographs, Instrumentation, Sounding, SUBSURFACE INVESTIGATIONS, Sands, Aquifers.
Identifiers: Groundwater prospecting.

In sandy areas the groundwater level can be revealed by seismic refraction measurements. In arenaceous grounds the groundwater level shows a characteristic sudden velocity increase; the groundwater table is in general a refracting boundary. The propagation velocity of compressional seismic waves in the dry sands overlying the groundwater level is 200-350 m/s in general, while in the saturated, wet sands the characteristic value is 1200-1500 m/s. At the groundwater level the acoustic inpedance shows a significant jump, which is partly due to the increase in velocity, and partly to the difference in density. The high increase in impedance accounts for the observed very low energy of waves refracted on the groundwater table. (Knapp-USGS)
W71-00860

THE POISEUILLE ANALOGUE FOR FLOW OF WATER IN WYOMING BENTONITE,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Soils.
A. V. Blackmore.
Journal of Hydrology, Vol 11, No 1, p 59-68, July 1970. 10 p, 2 fig, 1 tab, 22 ref.

Descriptors: *Groundwater movement, *Bentonite, *Hydraulic gradient, Darcys law, Hydrostatic pressure, Porosity, Ion transport, Clays, Porous media, Ion exchange, Membrane processes, Viscosity, Osmosis.
Identifiers: Poiseuille flow.

Water movement, parallel to the plane of orientation, is measured in a Wyoming bentonite as a function of hydrostatic pressure gradient and interparticle spacing; a simple system and technique are used so that some of the difficulties normally associated with the movement of water through reactive materials are avoided. The data are interpreted with the object of establishing a mathematical model based on the slit analogue of the Poiseuille equation, modified for electro-osmosis and anomalous viscosity, as suggested by Kemper. Pore velocity, at constant spacing, is very nearly proportional to pressure gradient (Darcy's law) while at constant pressure gradient it is linearly related to the square of the spacing. When the implications of these results are applied to the analogue an expression is obtained that describes the flow in a satisfactory manner. This expression is compared with one developed for flow in inert materials both within and beyond the limits of the present experiment. (Knapp-USGS)
W71-00863

EVAPORATION OF GROUNDWATER FROM COASTAL PLAYAS (SABKHAH) IN THE ARABIAN GULF,
Raikes and Partners, Rome (Italy).
For primary bibliographic entry see Field 02D.
W71-00865

WATER RESOURCES OF THE CENTRAL NEW YORK REGION,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 02E.
W71-00894

GEOLOGY AND GROUNDWATER RESOURCES OF THE ASHEVILLE AREA, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
Henry Trapp, Jr.
North Carolina Department of Water Resources Ground Water Bulletin No 16, April 1970. 127 p, 14 fig, 28 tab, 29 ref.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, North Carolina, Water wells, Water supply, Water quality, Water yield, Geology, Water levels, Data collections, Hydrologic data.
Identifiers: Asheville (NC), Madison County (NC), Buncombe County (NC), Henderson County (NC), Transylvania County (NC).

The Asheville area, comprising Madison, Buncombe, Henderson, and Transylvania Counties, covers 1,860 square miles entirely within the Blue Ridge province in western North Carolina. Springs are the most important source of water in northwestern Madison County for homes, small communities, schools, and other institutions. Dug wells are of some importance as a source of groundwater, whereas bored wells are comparatively rare. The average drilled well in the area is 120 feet deep and has a reported yield of about 15 gallons per minute. Generally, the groundwater is slightly acid, contains less than 100 ppm dissolved solids, and is soft. Dug wells are considerably more susceptible to contamination than springs or drilled wells. Groundwater types can be mapped but are shown to extend across, and change within, boundaries of rock units. Thermal springs occur at Hot Springs in Madison County. The thermal water has a calcium sulfate composition, more than three times the dissolved solids of other groundwater in the Asheville area, and temperatures greater than 100 deg F. (Knapp-USGS)
W71-00903

WATER RESOURCES OF THE CHAMPLAIN-UPPER HUDSON BASINS IN NEW YORK STATE,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 02E.
W71-00906

RECHARGING THE OGALLALA FORMATION USING SHALLOW HOLES,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 04B.
W71-01058

TAUNTON RIVER BASIN-MASSACHUSETTS BASIC-DATA REPORT NO. 12, GROUNDWATER SERIES,
Geological Survey, Boston, Mass.
For primary bibliographic entry see Field 04B.
W71-01089

MULTIVARIATE ANALYSIS IN GROUNDWATER HYDROLOGY -- THEORY,
California State Coll., Long Beach. Dept. of Civil Engineering.
A. Eshett.
Water Resources Bulletin, Vol 6, No 5, p 821-825, September-October 1970. 5 p.

Descriptors: *Mathematical models, *Groundwater movement, *Recharge, *Aquifers, Water resources development, Data processing, Statistical models, Statistical methods, Hydrogeology, Correlation analysis, Systems analysis, Linear programming.
Identifiers: Multivariate analysis.

A practical model was developed for the unique determination of the recharge into an aquifer system. The analysis is used to estimate the coefficients of the linear relationship which represent the effective contributions into a groundwater system. The model may be used for the analysis of historic and observed data. The estimates of the procedure are unbiased and consistent, and the statistical model has a good asymptotic efficiency. The application of the statistical analysis to a field situation can be readily carried out. The determination of the effective recharge for distinct hydrologic elements should enable the hydrologist to compute the aquifer response and match it with corresponding historic data. (Knapp-USGS)
W71-01098

2G. Water in Soils

EQUATIONS FOR APPROXIMATING VERTICAL NONSTEADY-STATE DRAINAGE OF SOIL COLUMNS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Ray D. Jackson, and Frank D. Whisler.
Soil Science Society of America Proceedings, Vol 34, No 5, p 715-718, September-October 1970. 4 p, 5 fig, 1 tab, 13 ref.

Descriptors: *Soil water movement, *Drainage, *Unsteady flow, Hydraulic conductivity, Capillary action, Mathematical models, Equations, Simulation analysis, Unsaturated flow.
Identifiers: Soil drainage.

Equations are derived, from a capillary tube model, that predict vertical nonsteady-state drainage from soil columns over the entire time of drainage for which experimental data are available. The model assumes that a soil column is a bundle of capillaries of various radii with the effective conductivity of the column decreasing as drainage progresses. The conductivity is first considered to be a linear function of the average water level in the column, and then considered to be a quadratic function of the water level. Both resulting equations predict drainage reasonably well when particular values are assigned to the ratio of the average height of capillary rise to the column length. A simplified expression is obtained by neglecting an insignificant term and assigning values to constants in the equation in which the conductivity was taken as a quadratic function of the average water level. The equations are compared with experimental data. (Knapp-USGS)
W71-00552

SOLUBILITY AND HYDROLYSIS OF ALUMINUM IN SOIL SOLUTIONS AND SATURATED-PASTE EXTRACTS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 02K.
W71-00553

EFFECTS OF STEMFLOW WATER ON A MIAMI SOIL UNDER A BEECH TREE: I. MORPHOLOGICAL AND PHYSICAL PROPERTIES,
Ohio Agricultural Research and Development Center, Wooster.
P. L. Gersper, and N. Holowaychuk.
Soil Science Society of America Proceedings, Vol 34, No 5, p 779-786, September-October 1970. 8 p, 8 fig, 3 tab, 16 ref.

Descriptors: *Stemflow, *Soil-water-plant relationships, *Soil formation, *Soil horizons, Soil chemistry, Soil texture, Soil water movement, WATER CHEMISTRY.
Identifiers: Beech trees.

The effects of the stemflow portion of the biohydrologic soil-forming factor on the physical properties of a Miami soil under a beech tree were determined by comparing properties of soil profiles located at different distances from the tree stem. The most obvious effects of stemflow water are a thickening of the A2 horizon, considerable low-chroma mottling in the B horizon, and an increase in the number of subdivisions of the B horizon. Bulk density of the A1 horizon was lowered considerably. Clay content of the A horizon was increased while the content of the B2 horizon was decreased. Correspondingly, the silt content of the A horizon was decreased while the content of the B2 horizon was increased. (Knapp-USGS)
W71-00554

EFFECTS OF STEMFLOW WATER ON A MIAMI SOIL UNDER A BEECH TREE: II. CHEMICAL PROPERTIES,
Ohio Agricultural Research and Development Center, Wooster.
P. L. Gersper, and N. Holowaychuk.
Soil Science Society of America Proceedings, Vol 34, No 5, p 786-794, September-October 1970. 9 p, 11 fig, 3 tab, 30 ref.

Descriptors: *Stemflow, *Soil-water-plant relationships, *Soil chemical properties, Soil formation, Soil physical properties, Soil structure, Soil horizons, Soil chemistry, Soil texture, Soil water movement, Water chemistry.
Identifiers: Beech trees.

The stemflow component of the biohydrologic soil-forming factor caused a much wetter environment, of highly enriched water, in a Miami soil contiguous to a beech tree stem than that prevailing in this soil farther from the stem. This markedly affected the soil such that in A horizons there were progressive increased inward toward the stem in organic C, total N, exch. acidity, exch. K, CEC, and free Fe2 03; and progressive inward decreases in pH, exch. Ca, exch. Mg, and base saturation. In B horizons there were progressive inward decreases in pH, exch. Ca, exch. Mg, exch. K, CEC, base saturation, and free Fe2 03. (Knapp-USGS)
W71-00555

DETACHMENT OF SOIL AGGREGATES BY SIMULATED RAINFALL,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 02J.
W71-00556

FIELD MEASUREMENT OF SOIL WATER DIFFUSIVITY,
Wisconsin Univ., Madison. Dept. of Soil Science.
W. R. Gardner.
Soil Science Society of America Proceedings, Vol 34, No 5, p 832-833, September-October 1970. 2 p, 3 ref.

Descriptors: *Soil water movement, *Diffusivity, Diffusion, Unsaturated flow, Capillary conductivity, Hydraulic conductivity.
Identifiers: Soil water diffusivity.

A method is described for calculating the soil water diffusivity of a field profile during drainage. The time rate of increase of soil suction is shown to be related to the diffusivity in a simple way through an approximate solution of the unsaturated flow equation. (Knapp-USGS)
W71-00557

STEADY INFILTRATION FROM LINE SOURCES AND FURROWS,
Agricultural Research Service, Madison, Wis., and Wisconsin Univ., Madison. Coll. of Agriculture.
P. A. C. Raats.
Soil Science Society of America Proceedings, Vol 34, No 5, p 709-714, September-October 1970. 6 p, 5 fig, 22 ref.

Descriptors: *Furrow irrigation, *Infiltration, *Unsaturated flow, *Leaching, Soil water movement, Irrigation design, Irrigation efficiency, Flow, Irrigation systems, Hydraulic conductivity, Equations, Steady flow, Unsteady flow.
Identifiers: Stream function, Partly saturated flow.

Steady infiltration from an array of equally spaced line sources or furrows at the surface of a semi-infinite soil profile is analyzed, based on the assumption that the hydraulic conductivity is an exponential function of the pressure head. Under this assumption, the matric flux potential and the stream function for plane flows satisfy the same linear partial differential equation. Explicit expressions for the stream function, the flux, the matric flux potential, the pressure head, and the total head are obtained. Some implications with regard to furrow irrigation are discussed. The solution provides a rational basis for the discussion of leaching under furrow irrigation. (Knapp-USGS)
W71-00558

THE EFFECT OF CONTACT POINTS O SPECIFIC RETENTION OF RUBBLY ROC PARTICLES,
Khartoum Univ. (Sudan). Dept. of Geology.
For primary bibliographic entry see Field 02F.
W71-00594

SOIL-WATER SAMPLING USING PAN AN DEEP PRESSURE-VACUUM LYSIMETERS,
Pennsylvania State Univ., University Park. Miner Conservation Section; and Water and A Resources Commission, Dover, Del.
Richard R. Parizek, and Burke E. Lane.
Journal of Hydrology, Vol 11, No 1, p 1-21, Ju 1970. 21 p, 8 fig, 1 tab, 14 ref.

Descriptors: *Lysimeters, *Soil water, *Samplin Monitoring, Irrigation water, Soil water movemer Percolation, Infiltration, Water balance, Pennsy vania, Instrumentation, Leaching, Path of poll tants, Landfills, Water quality.
Identifiers: Suction lysimeters.

Two soil-water sampling devices and succe achieved in obtaining soil water on a routine ba at depths of 1 to 36 feet below land surface a described. In one facility, metal pans with copp spounts are driven into the wall of an open tren to intercept gravitational water to a depth of feet. From 4 to 6 inches of water are irrigated a jacent to the trench on a weekly basis. The de trench lysimeter provides gravitational water sa ples on a routine basis when waters are artificia applied to the site but failed to yield samples duri the growing season in the absence of irrigati under Pennsylvania's climate. A modified versi of a commercially available lysimeter can extra soil water under tension from depths in excess of feet. This improved soil-water sampler has be named a pressure-vacuum lysimeter or 'sucti lysimeter'. One or more lysimeters may be install in a 6-inch diameter drill hole. The ceramic tip embedded in a pulverized silica deposit to insu hydraulic continuity with the soil-water reservo When sufficient soil-moisture is available 500 970 mls of water may be obtained on a weekly b sis. During prolonged dry periods, no samples c be collected when soil water has been deplet around the ceramic point. This may be 4 to 8 wee after pan lysimeters fail to yield water samples. (napp-USGS)
W71-00598

A POLAROGRAPHIC TECHNIQUE FOR TH MEASUREMENT OF DISSOLVED SULPHI IN WATERLOGGED SOILS,
University Coll. of South Wales and Mo mouthshire, Cardiff. Dept. of Botany.
For primary bibliographic entry see Field 02K.
W71-00616

THE MOISTURE REGIMES OF SOI DEVELOPED ON KEUPER MARL,
Soil Survey of England and Wales.
A. J. Thomasson, and J. D. Robson.
Journal of Soil Science, Vol 18, No 2, p 329-3 September 1967. 12 p, 4 fig, 5 tab, 20 ref.

Descriptors: *Soil moisture, *Regime, Foreign p jects, Moisture content, Soil profiles, Poros Precipitation (Atmospheric), Water levels.

lentifiers: Moisture release, Subsoiling effects.

he moisture regimes of several representative rofiles of the Worcester series developed on euper Marl in England and Wales are described nd interpreted using a simple field technique sup- emented by determinations of pore space, oisture content, and moisture release charac- ristics. It is suggested that the textural B horizon coarse blocky structure is the cause of water- gging which occurs seasonally in the upper 61 cm these soils. The C horizon, which has a fine ocky structure and a lower clay content, is more rmeable, and determinations of pore space and oisture content showed an appreciable volume of voids in it when the overlying horizons were lly saturated with water. After subsoiling to a pth of 76 cm at one site, the soil was waterlogged s often and then only for shorter periods than rmerly. (Woodard-USGS)
71-00617

ROPERTIES OF DEEP SANDY SOILS AND HE GROWTH OF LOVEGRASS, RAGROSTIS CURVULA (SCHRAD.) NEES,
ommonwealth Scientific and Industrial Research rganization, Wembley (Australia).
Farrington, and N. A. Campbell.
stralian Journal of Soil Research, Vol 8, No 2, p 3-132, July 1970. 1 fig, 5 tab, 24 ref.

escriptors: *Soil properties, *Grasses, *Plant owth, *Soil-water-plant relationships, *Sands, il types, Soil moisture, Soil texture, Semiarid cli- tes, Nutrients, Fertilizers, Water table, Rainfall, ot systems, Crop production, Silts, Clays, Soil echanics.
ntifiers: *Lovegrass, *Australia, *Depth to ter.

eld studies of lovegrass (Eragrostis curvula chrad.) Nees) were undertaken in the deep ndy soils of Western Australia in an effort to cover how soil properties affect the annual grass ld. Sites were tested for a water table down to m. On those plots which had a water table there s a close relationship between annual yield and two following properties: depth to the water le and silt and clay content in the 30-60 cm soil er. This relationship, maintained through the rs and over a range of nutrition levels, ac- unted for 87% of the between-site variation in ld. At sites without a water table there was a h negative correlation (PS0.001) between the vival rate of the grass and the coarse sand con- t of the soil profile. Soil mechanical composition s the most important determinant of yield. In mmary, strong associations between yield, chanical composition, and depth to water sug- ted that soil moisture status exerted the greatest trol on growth of grass. (Carr-Arizona)
1-00686

ANT DESICCATION CRACKS IN CENTRAL UTH DAKOTA SOILS,
ith Dakota State Univ., Brookings.
M. White.
l Science, Vol 110, No 1, p 71-73, July 1970. 2 6 ref.

escriptors: *Cracks, *Sinks, *South Dakota, il moisture, *Soil environment, Alfalfa, Soil er, Soil-water-plant relationships, Semiarid cli- tes, Soil types, Clays, Silts, Soil surfaces.
ntifiers: *Desiccation cracks, *Prisms.

kholes in central South Dakota occur when 20 30 cm wide subsoil desiccation cracks extend ward to the surface. Surface soil collapsing into cracks forms holes which are 1 to 3 m wide and o 3 m deep. A desiccation and contraction cess takes place in the clay and silty soils as ll prisms give way to large prisms. In humid as the subsoil remains moist and in arid areas subsoil is already dry, so that subsoil cracks sel- n occur in these regions. It appears that desicca- n cracks are confined to semiarid areas. Since al- a has perennial roots that can dry the soil to great depth and since sinkholes are most common in 5 to 10 year old alfalfa fields, indications are that water consumption and evapotranspiration by alfalfa cause subsoil desiccation. (Carr-Arizona)
W71-00696

SOIL MOISTURE EFFECTS ON COMPETITIVE ABILITY OF WEEDS,
Southwestern Great Plains Research Center, Bushland, Tex.
Allen F. Wiese, and C. Wendell Vandiver.
Weed Science, Vol 18, No 4, p 518-519, July 1970. 3 fig, 9 ref.

Descriptors: *Weeds, *Competition, *Plant growth, *Dry farming, *Soil moisture, Soil water, Weed control, Wilting, Corn (Field), Sorghum, Agronomy, Arid lands, Semiarid climates, Irrigation, Drying, Wetting, Grasses, Soil-water-plant relationships.
Identifiers: *Russian thistle, *Irrigated agriculture, Dry matter.

Ten species of plants were grown in competition with each other at wet, medium, and dry soil moisture levels in a greenhouse. Corn (Zea mays L.), barnyardgrass (Echinochloa crusgalli (L.) Beauv.), cocklebur (Xanthium pensylvanicum Wallr.), large crabgrass (Digitaria sanguinalis (L.) Scop.), and sorghum (Sorghum vulgare L., var. RS 626) produced the most dry matter when growing in wet soil. These species showed a great reduction in growth on dry soil. Palmer amaranth (Amaranthus palmeri S. Wats.) grew moderately well on wet and medium soil, but less well on dry soil. Even though kochia (Kochia scoparia (L.) Schrad.), Russian thistle (Salsola kali L., var. tenuifolia Tausch), buffalobur (Solanum rostratum Dunal.), and tumblegrass (Schedonnardus paniculatus (Nutt.) Trel.) produced less dry matter than the other species under wet conditions, their growth was not reduced in dry soil. In fact, kochia and Russian thistle produced their greatest amount of dry matter under dry conditions. These results show that soil moisture conditions greatly affect the competitive ability of the weeds. This should partially explain why kochia, Russian thistle, buffalobur, and tumblegrass are problems in dryland farming in arid and semiarid areas, while barnyardgrass, cocklebur, and large crabgrass are pests on irrigated farms. (Carr-Arizona)
W71-00701

CLAY WATER INTERACTIONS. AN EXPERIMENTAL STUDY OF INTERFACE PHENOMENA,
Royal Inst. of Tech., Stockholm (Sweden). Nuclear Magnetic Resonance Group.
E. Froslind, and A. Jacobsson.
Available from NTIS as AD-710 418, $3.00 in paper copy, $0.95 in microfiche. Final Technical Report, May 1970. 55 p.

Descriptors: *Nuclear magnetic resonance, Montmorillonite, *Montmorillonite, Surface properties, Water, Adsorption, Colloids, Interfaces, Dielectric properties, Crystal structure, Sweden, *Surface chemistry, *Hectorite, Mineral.

The structural properties of water adsorbed on hydrophilic intercrystalline clay mineral surfaces have been investigated by way of NMR and dielectric measuring techniques. It is shown that structural ordering of the adsorbed water layers occurs, that the adsorption takes place independent at the exchange cations present in the intercrystalline spaces and that these ions only modify the structural and relaxation properties of the water. The conventional hypotheses regarding the origin of the hydrophilic clay properties are shown to be untenable.
W71-00803

THROUGHFLOW ON HILLSLOPES AND ITS RELATION TO THE STREAM HYDROGRAPH,
Bristol Univ. (England).
D. R. Weyman.
Bulletin International Association of Scientific Hydrology, Vol 15, No 3, p 25-33, September 1970. 9 p, 3 fig, 11 ref.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Surface-groundwater relationships, *Subsurface runoff, *Soil water movement, Hydrograph analysis, Subsurface drainage, Percolating water, Base flow, Hydrographs, Overland flow, Flood forecasting.
Identifiers: Throughflow.

Throughflow was measured from three soil horizons on a 12 deg slope. Storm flow comes from the 10-45 cm horizon and is controlled by the upslope extent of saturated conditions. Base flow comes from the 45-75 cm horizon and is supplied by slow unsaturated flow from the whole soil mass to a small constant zone of saturation. Differences between input and output stream hydrographs over 270 m of channel are attributed to throughflow and correlate well with measured values providing a basis for separating throughflow components from the stream hydrograph. Observed stream flows contain no overland flow or groundwater flow components. The main basin flood peak is not generated within this control section of channel but is produced in the headwater zone by the faster runoff characteristics of the soils in that area and by topographic factors which lead to rapid channel extension. (Knapp-USGS)
W71-00858

RESPONSE UNITS FOR EVALUATING THE HYDROLOGIC PERFORMANCE OF RANGELAND WATERSHEDS,
Agricultural Research Service, Boise, Idaho. Northwest Watershed Research Center.
C. B. England, and G. R. Stephenson.
Journal of Hydrology, Vol 11, No 1, p 89-97, July 1970. 9 p, 1 fig, 2 tab, 14 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Soil water movement, Soil texture, Simulated rainfall, Rainfall simulators, Mathematical models, Storage capacity, Water storage, Permeability, Grasslands, Soil conservation, Water conservation, Hydrograph analysis, Systems analysis.
Identifiers: Rangelands.

A technique is presented for isolating areas within rangeland watersheds which are homogeneous enough in hydrologic characteristics to permit their use as field experimental units or as computational units in hydrograph synthesis. A study of the interactions among geology, soils, topography, and climate on the 90-square mile Reynolds Creek Experimental Watershed, Idaho, revealed predictable relations among these features and the capacity of a given unit of landscape to retain precipitation. The range site concept incorporates similar considerations and may be used in deriving hydrologic units for synthesizing the hydrology of ungaged areas. (Knapp-USGS)
W71-00866

SOIL WATER MEASUREMENT BY A LOW-RESOLUTION NUCLEAR MAGNETIC RESONANCE TECHNIQUE,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 07B.
W71-00870

RELATION OF SOIL HYDRAULIC CONDUCTIVITY TO EXCHANGEABLE CATIONS AND SALINITY,
New Mexico State Univ., University Park. Dept. of Agronomy.
Hessam Mojallali, and H. E. Dregne.
New Mexico State University Agricultural Experiment Station Bulletin 540, November 1968. 11 p, 3 fig, 2 tab, 16 ref.

Descriptors: *Hydraulic conductivity, *Soil water movement, *Ion exchange, *Adsorption, *Soil

chemistry, Soil chemical properties, Soil physical properties, Chlorides, Sodium, Potassium, Ammonia, Calcium, Magnesium, Leaching.
Identifiers: Soil salinity effects.

Leaching experiments on a calcareous Berino sandy loam subsoil showed that soils saturated with exchangeable sodium, potassium, and ammonium became completely impermeable when leached with distilled water. Hydraulic conductivity decreased slightly on soils leached with distilled water after saturation with exchangeable calcium and magnesium. Continued leaching over a six-week period with 5-percent solutions of chloride salts produced a gradual decrease in soil conductivity with sodium and magnesium, but no change with potassium and calcium. Resin column hydraulic conductivity varied with the type of chloride salt used even when the electrical conductivity of the chloride solutions was the same. Hydraulic conductivity decreased in the order of potassium, sodium, calcium, and magnesium, just as in the high salt soil column treatments. Soil hydraulic conductivity is a function of both the elctrical conductivity and the kind of cation of the leaching water. (Knapp-USGS)
W71-00895

A RATIONAL APPROACH TO THE DESIGN OF CHECK SYSTEMS OF IRRIGATION,
Punjab Agricultural Univ., Hissar (India). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
W71-00951

RECLAMATION OF A SALINE-ALKALI SOIL IN THE UPPER INDUS BASIN,
For primary bibliographic entry see Field 03F.
W71-00952

THE RELATIONSHIP BETWEEN HEAT TREATMENT AND WATER REPELLENCY IN SOILS,
Forest Service (USDA), Glendora, Calif. Pacific Southwest Forest and Range Experiment Station.
L. F. DeBano.
In: Symposium on Water-Repellent Soils, Proceedings, University of California, Riverside, May 6-10, 1968, Pub March 1969, p 265-279. 4 fig, 2 tab, 4 ref.

Descriptors: *Soil sealants, *Wettability, *Burning, *Chaparral, *Soil water movement, Volatility, Heat treatment, Soil physical properties, On-site investigations, Laboratory tests, Semiarid climates, Convection, Condensation, Soil temperature, Soil texture, Soil investigations, Soil structure, California, Watersheds (Basins).
Identifiers: *Water-repellent soils, Litter, Vaporization.

Samples of water-repellent soils from a burned-over chaparral area were heated in a muffle furnace over temperature ranges of 300-900 degrees fahrenheit (F). Burning times varied in separate samples over 5-20 minutes. From 300-800 F, water-repellency increased with temperature and teatment time, and decreased over 800 F. Calculations of soil temperatures at various depths as a function of surface temperature indicate that the intensification of repellency in situ is unlikely and that volatilization, convection and condensation of hot gases may be occurring. Two subsequent experiments were performed: (1) A 2-inch layer of water-repellent soil was placed over wettable sand and the surface was heated to 1400 F and (2) A 1-1/2 inch layer of undecomposed litter was placed over wettable sand and surface heated until the 3-inch depth reach 200 F. In both cases hydrophobic layers moved down through the soil to deeper depths. These results are similar to recent observations in burned-over areas. Probably the downward movements of volatilized hydrophobic substances are affected by soil texture as well as surface temperature. (Casey-Arizona)
W71-00960

FACTORS RESPONSIBLE FOR WATER REPELLENCE OF SOILS,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia).
R. D. Bond.
In: Symposium on Water-Repellent Soils, Proceedings, University of California, Riverside, May 6-10, 1968, Pub March 1969, p 259-264. 1 fig, 11 ref.

Descriptors: *Soil fungi, *Soil water movement, *Soil sealants, Soil environment, Soil microbiology, Soil moisture, Semiarid climates, Arid lands, On-site investigations, Soil investigations, Shrubs, Acids, Fungi, Infiltration, Sands, Seasonal, Variability.
Identifiers: *Water-repellent soils, *Australia.

Observations made on a variety of Australian soils showed a close correlation between the presence of fungi and soil water repellence. Occurrance of specific fungal species seems to be dependent on specific shrub species. It is felt that such associations may explain variations of water repellency beneath differing plant communities. Extraction of water-repellent soils with nonpolar compounds left repellency unaltered, but extraction with acids considerably reduced it. Seasonal variations in water repellency occur in Mediteranean-type climates in South Australia. The greatest levels existed in the autumn after onset of rains and lowest levels took place in the dry summer. (Casey-Arizona)
W71-00961

SYNTHETIC HYDROPHOBIC SOILS FOR HARVESTING PRECIPITATION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 03B.
W71-00962

CONTRIBUTION OF SOME SOIL FUNGI TO WATER REPELLENCY IN SOIL MATERIALS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
S. M. Savage.
Supported by U.S. Department of Agriculture, Forest Service Grant No. 4000. In: Symposium on Water-Repellent Soils, Proceedings, University of California, Riverside, May 6-10, 1968, Pub March 1969, p 241-257. 5 fig, 3 tab, 16 ref.

Descriptors: *Soil sealants, *Wettability, *Soil physical properties, *Soil fungi, *Soil texture, Soil water movement, Chaparral, Soil temperature, Clays, Sands, Laboratory tests, Soil structure, Soil investigations, Repellents, Fungi, California, Organic matter, Heating.
Identifiers: *Water-repellent soils.

Eight different fungal species were collected and isolated from water-repellent soils of California chaparral areas and injected into sterilized quartz sand with nutrient media. Each culture was incubated for 7, 17, 33 and 53 days. Water repellency appeared, slightly, only in cultures of Penecillium nigricans and Aspergillus sydowi. When the 53-day cultures were heated from 200-400 degrees centigrade, all demonstrated water repellency which decreased with increasing temperature. Solvent extraction indicated that the repellency substances were polar in nature and chemically altered by heating. Cultures of A. sydowi and P. nigricans were initiated in sand-clay mixtures. Results with A. sydowi were: (1) An extremely high repellency occurred in 1 percent clay which decreased with increasing clay percentages and, (2) The sand-clay cultures contained almost twice as much organic matter as the pure sand cultures. By contrast, the wettability of the P. nigricans cultures increased in sand-clay mixtures. The implications of these results are discussed in this paper. It is felt that natural soil-water repellency is probably a product of microbial action. (Casey-Arizona)
W71-00963

THE GRAVIMETRIC METHOD OF SOIL MOISTURE DETERMINATION, PART I - A STUDY OF EQUIPMENT, AND METHODOLOGICAL PROBLEMS,
South Pacific Regional Coll. of Tropical Agriculture, Alafua (Western Samoa).
S. G. Reynolds.
Journal of Hydrology, Vol 11, No 3, p 258-273, September 1970. 16 p, 1 fig, 6 tab, 28 ref.

Descriptors: *Gravimetry, *Soil moisture, *Sampling, *Laboratory tests, Gravimetric analysis, Soil moisture meters, Moisture content, On-site tests, Analytical techniques, Cores, Soil analysis, Test procedures.
Identifiers: Soil moisture analysis.

The type of sampling device, whether a screw or coring auger, is shown to influence soil moisture determinations. Moisture losses after storage of samples in glass tubes or aluminum foil for periods up to 7 days are shown to be negligible. Aluminum foil is recommended as a very inexpensive and efficient container. As the rate and length of drying needed for different soils is quite variable, preliminary investigations should be undertaken to establish the times after which negligible losses occur for further periods of drying. In most field studies samples of 50-100 q of soil are adequate; larger samples of 500 q require much longer periods of drying but give similar results. Methodological problems discussed include the site destruction caused by the gravimetric method and the fact that the method itself accounts for some of the variability found in soil moisture distribution and possibly for supposedly significant changes in soil moisture content in time and space. (See also W71-01065) (Knapp-USGS)
W71-01064

THE GRAVIMETRIC METHOD OF SOIL MOISTURE DETERMINATION, PART II - TYPICAL REQUIRED SAMPLE SIZES AND METHODS OF REDUCING VARIABILITY,
South Pacific Regional Coll. of Tropical Agriculture, Alafua (Western Samoa).
S. G. Reynolds.
Journal of Hydrology, Vol 11, No 3, p 274-287, September 1970. 14 p, 1 fig, 5 tab, 24 ref.

Descriptors: *Gravimetry, *Sampling, *Soil moisture, Laboratory tests, Gravimetric analysis, Soil moisture meters, Moisture content, Analytical techniques, Cores, Soil analysis, Test procedures.
Identifiers: Soil moisture analysis.

The variability of soil moisture in the 0-8 cm horizon was studied over a range of soil types. Typical sample sizes required to estimate the true mean within variability limits of 10%, 5% and 2% are discussed. The magnitude of variability is shown to vary greatly from area to area, depending in particular upon the stoniness and nature of the soil and the type and extent of the vegetation cover. Three methods which might reduce sample size are the use of the gravimetric volume basis method instead of the weight basis method, removal of surface vegetation, and removal of stones and rhizomes from samples. (See also W71-01066) (Knapp-USGS)
W71-01065

THE GRAVIMETRIC METHOD OF SOIL MOISTURE DETERMINATION, PART III - EXAMINATION OF FACTORS INFLUENCING SOIL MOISTURE VARIABILITY,
South Pacific Regional College of Tropical Agriculture, Alafua (Western Samoa).
S. G. Reynolds.
Journal of Hydrology, Vol 11, No 3, p 288-3, September 1970. 13 p, 4 fig, 4 tab.

Descriptors: *Soil moisture, *Vegetation effects, *Variability, Sampling, Rainfall, Solar radiation, On-site tests, Climates, Seasonal, Heat budget, Evapotranspiration, Moisture content, Retention, Root zone, Slopes, Rainfall, Weather, Soil physical properties.

lentifiers: Soil moisture variability.

he influence of various environmental factors on oil moisture variability in the 0-8 cm horizon is examined. The investigation of the influence of egetation types revealed at least three tentative riability groups (in order of increasing variabili-) corresponding to areas of recent cultivation, eas of permanent or ley grass, and predominantly ncultivated moor or heathland areas. The dynam- nature of seasonal variability changes are illus- ated and correlations established with the nounts of rainfall and insolation in the week eceding sample collection, and the degree of oisture saturation at the time of sampling. equired sample size was directly related to mean oisture content, or the degree of moisture satura- n, and the amount of insolation. It is suggested erefore that a decrease in soil moisture content is sociated with a decrease in the variance of sam- e means, and an increase in moisture content is sociated with an increase in variance. (See also 71-01064) (Knapp-USGS)
71-01066

H. Lakes

APPROACH TO RESERVOIR TEMPERA- RE ANALYSIS,
my Corps of Engineers, Sacramento, Calif., drologic Engineering Center.
o R. Beard, and R. G. Willey.
ater Resources Research, Vol 6, No 5, p 1335-45, October 1970. 11 p, 7 fig, 2 tab, 4 ref.

scriptors: *Reservoir operation, *Mathematical odels, *Water temperature, *Water quality con- l, *Computer programs, Water management pplied), Reservoir design, Regulation, Reservoir rage, River forecasting, Data processing, Water ality, Water yield, Water resources develop- nt.
ntifiers: Reservoir water temperature predict-

eral recent mathematical models for analyzing ervoir temperature stratification involve ex- ination of hourly temperature changes. Their in practical applications is limited by the large ount of data required, and a more general model calculate reservoir storage for bridging long ught periods requires examination of many nbinations of reservoir storage levels and sonal inflow patterns. Because 30 or more years lata are required, the model is practical only if a g computation interval, such as one month, can used. A practical management model must use eralized data such as average air temperature average radiation must be capable of planning ases through specific outlets or automatically cting the outlets that will maintain outflow tem- atures within a desired range as long as possible the temperature of the remaining stored water uld be held at an optimum value. A computer gram was developed that conforms to these uirements and automatically calibrates the del. (Knapp-USGS)
1-00567

RTICAL TEMPERATURE STRUCTURE AND TER SURFACE HEAT EXCHANGE,
nsylvania Univ., Pa.
n Eric Edinger.
er Resources Research, Vol 6, No 5, p 1392-5, October 1970. 4 p, 1 fig, 1 tab, 6 ref.

criptors: *Water temperature, *Heat transfer, xing, Meteorology, Lakes, Convection, Mathe- ical studies, Diffusion, Dispersion, Heat budget, t balance, Seasonal, Thermal stratification, ervoirs.
tifiers: Temperature structure (Lakes).

alance is assumed between the time change in storage and the net vertical dispersive heat sfer within a water column. The average sur- temperature and its amplitude are related to surface heat exchange using the concept of equilibrium temperature. This results in a set of relationships for using meteorological data for estimating the seasonal time-variance of vertical temperature structure of lakes or reservoirs. (Knapp-USGS)
W71-00568

WATER BALANCE OF LAKE CHALA AND ITS RELATION TO GROUNDWATER FROM TRITIUM AND STABLE ISOTOPE DATA,
International Atomic Energy Agency, Vienna (Austria).
Bryan R. Payne.
Journal of Hydrology, Vol 11, No 1, p 47-58, July 1970. 12 p, 3 fig, 2 tab, 12 ref.

Descriptors: *Surface-groundwater relationships, *Lakes, *Tracers, *Water balance, *Tritium, Hydrologic budget, Stable isotopes, Radioisotopes, Tracking techniques, Recharge, Discharge (Water), Groundwater movement, Water chemistry, Water yield, Irrigation water.
Identifiers: Lake Chala (Kenya).

Artificially injected tritium was used to estimate the water balance of Lake Chala, Kenya, which has no surface inflow or outflow. Over 5 years mean annual subsurface inflow and outflow are estimated to be 12.5 million cu m and 8.2 million cu m respectively. Environmental tritium cannot be used for such a balance estimation. The relation of the lake to springs in the area was studied on the basis of the deuterium and oxygen-18 content of the waters. None of the springs derives a major component of its discharge from the lake. Tritium concentrations of two springs point to a high probability of partial recharge by lake water. (Knapp-USGS)
W71-00601

DYNAMIC MODEL STUDY OF LAKE ERIE, PART I. SIMILITUDE CRITERIA AND EXPERIMENTAL SET-UP,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
Ralph R. Rumer, Jr.
Available from NTIS as PB-195 544, $3.00 in paper copy, $0.95 in microfiche. Civil Engineering Report No. 18.1, August, 1970. 43 p, 9 fig, 21 ref. FWQA Program Grant WP-00837.

Descriptors: *Lake Erie, *Model studies, *Hydraulic models, *Simulation analysis, Currents (Water), *Hydraulic similitude, Synthetic hydrology, Water circulation, Movement, Water quality, Water pollution control, Dilution.
Identifiers: Rotating model.

Both analytical and experimental investigations employed to provide basic information concerning water movement in the Lake. The knowledge and experience acquired in the course of this study should improve our capability to construct and operate rotating hydraulic models. This information should also assist in the overall water quality management of the Lake. The studies reported here deal with the idealized conditions of zero wind stress (including the inflow of the Detroit River and the outflow of the Niagara River) and, under this same flow condition, with the superposition of a uniform westerly wind over the surface of the Lake. The water mass is isothermal and variations in density are assumed absent. Under these conditions, investigations of the circulation patterns were conducted. Also studied was the oscillation of the entire water mass in the model lake. In particular, attention was given to the transient effect that this mass oscillation had on the otherwise steady-state circulation pattern and its effect on the mixing and dilution of waste discharges into the lake. The mixing and dilution of tracers introduced at various positions in the model lake were also studied under these same conditions of zero wind stress and constant throughflow and with the superposition of the westerly wind. A highly idealized model of Lake Erie was also constructed and operated. This model was rectangular in shape, of constant depth, and had the same length to width ratio as Lake Erie. Circulation patterns, the decay of sciches, and mixing of tracers were also studied in this idealized model. The results obtained from the idealized rectangular basin helped to delineate the major effects of geometrical variations that were present in the scaled Lake Erie model. This report recounts the development of the laboratory and the model lake and summarizes the analytical and experimental work accomplished thus far. (See also W71-00622).
W71-00621

DYNAMIC MODEL STUDY OF LAKE ERIE, PART II, ANALYTICAL AND EXPERIMENTAL RESULTS,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
Ralph R. Rumer, Jr.
Available from NTIS as PB-195 545, $3.00 in paper copy, $0.95 in microfiche. Civil Engineering Report No 18.2, August, 1970. 39 p, 2 tab, 22 fig, 33 ref. FWQA Program Grant WP-00837.

Descriptors: *Lake Erie, *Model studies, Hydraulic models, *Simulation analysis, Currents (Water), *Hydraulic similitude, Synthetic hydrology, Water circulation, Movement, Water quality, Water pollution control, Dilution.
Identifiers: Rotating model.

This second report considers the experimental results obtained and the relationship of these results to various mathematical model approaches to the hydraulic study of Lake Erie. Based on the experimental and analytical results of this study, the following summarizing statements are made regarding the dynamic behavior of Lake Erie. In the absence of wind, the throughflow caused by the inflow of the Detroit River and the outflow of the Niagara River generates significant currents and easily observable patterns of circulation. The presence of westerly wind significantly alters the circulation patterns of Lake Erie as observed in the absence of wind. A procedure for relating model wind speeds to prototype wind speeds based on similarity between wind set-up in model and prototype has been presented. The period for the first mode mass oscillation in the model lake is in good agreement with calculated and observed periods. Observed detention periods show significant short circuiting for the homogeneous lake with no wind stress. Only limited correspondence can be achieved in modeling dispersion in vertically distorted Froude models of very large bodies of water. (See also W71-0062).
W71-00622

COMPILATION OF DATA FOR MICHIGAN LAKES,
Geological Survey, Lansing, Mich.
J. B. Miller, and T. Thompson.
Geological Survey Open-file Report, June 1970. 368 p, 1 fig, 1 tab.

Descriptors: *Hydrologic data, *Lakes, *Synoptic analysis, Data collections, Gaging stations, Inflow, Lake stages, Hydrographs, Maps.
Identifiers: Lake outflow, Lake drainage area, Basic data.

Lake data collected in Michigan through water year 1968 (September 30, 1968) are presented. Included, for each lake, are a description of the lake, a list of discharge measurements made on the inlet and outlet streams, quality of water data, location maps, and lake-stage hydrographs. Daily readings of lake levels were usually made on the lakes, but in this report only the monthly extremes are shown in the hydrographs. That is, the highest and lowest readings each month are plotted. (Woodard-USGS)
W71-00637

PHOSPHATE REDUCTION IN LAKES BY PRECIPITATION WITH ALUMINIUM SULPHATE,
Swedish Water and Air Pollution Research Laboratory, Stockholm.
A. Jernelov.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 5 p, 4 fig, 1 tab.

Descriptors: *Chemical precipitation, *Phosphates, *Lakes, Aluminum, Sulfates, Eutrophication, Oxygen, Sediments, Algae, Calcium, Chlorophyta, Cyanophyta, Toxicity, Seasonal, Municipal wastes, Depth, Coliforms, Iced lakes, Diatoms, Water management, Water pollution control, Water quality control, Flocculation.
Identifiers: *Phosphate reduction, Stockholm (Sweden), Phragmites, Nymphaea, Grass- and silver-carps, Invertebrates, Mysis relicta, Neuropteran larvae, Cryptophyceae, Lake restoration.

Release of phosphate from anaerobic bottom sediments with and without addition of aluminum and calcium were studied. Aluminum was chosen rather than calcium because it gave better flocculation. Toxicological studies of invertebrates were made to determine effect of aluminum hydroxide formed at precipitation of lake water with aluminum sulphate. Experiments showed the most suitable time for adding aluminum sulphate was when the greatest amount of the 'mobile' phosphorus in the aquatic system was in phosphate form. Swedish shallow lakes should be precipitated in early spring immediately after ice desolution. In deeper lakes, the treatment can be done in spring or autumn, immediately before the circulation. Lake Langsjon--a eutrophic shallow lake near Stockholm--was precipitated in April 1968 with about 50 grams granulated aluminum sulphate/cubic meter of lake volume. Results were: lowered concentration of total phosphorus, somewhat better oxygenation during the 1968-1969 winter, and no release of phosphate from the sediments although conditions were anaerobic. As the trend for the standing crop of planktonic algae in the lake is negative, no certain effect of precipitation on algae numbers can be determined from the precipitation. (Jones-Wisconsin)
W71-00661

PHOTOSYNTHESIS AND ZONATION OF FRESHWATER MACROPHYTES. I. DEPTH DISTRIBUTION AND SHADE TOLERANCE,
Saint Andrews Univ. (Scotland). Dept. of Botany.
For primary bibliographic entry see Field 02K.
W71-00670

THE USE OF THE RADIOCARBON METHOD FOR SUBDIVISION OF PLANKTONIC ANIMALS ACCORDING TO THEIR TROPHIC LEVELS (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii; Akademii nauk SSR, Moscow. Institut Biologii Vnutrennjkh Vod.
For primary bibliographic entry see Field 07B.
W71-00671

DISTRIBUTION OF RIVER WATERS IN THE NORTHERN PART OF THE LAKE BAIKAL AS INDICATED BY HYDROCHEMICAL DATA (IN RUSSIAN),
V. T. Bogdanov.
Doklady Academy of Sciences of USSR, Vol 185, No 3, p 649-652, 1969. 1 fig, 2 tab, 4 ref.

Descriptors: *Lakes, *Tributaries, Chemical analysis, Hardness (Water), Oxygenation, Temperature, Winds.
Identifiers: Lake Baikal (USSR), Hydrocarbonates.

Waters of the rivers flowing into the northern part of the Lake Baikal are distinguished from the lake water by the relative contents of several constituents, such as hydrocarbonates, calcium, and silica, as well as the degree of hardness and oxygenation. These features permitted to establish the range of the beneficial influence of northern tributaries on the volume and oxygenation of the lake. The latter process is augmented by winds, especially those of the fall season. (Wilde-Wisconsin)
W71-00676

INTERRELATIONS BETWEEN SULPHUR AND CARBON TURNOVER IN MEROMICTIC LAKES,
Akademiya Nauk SSSR, Mowcow. Institut Biologii Vnutrennykh Vod.
Yu. I. Sorokin.
Archiv fur Hydrobiologie, Vol 66, No 4, p 391-446, 1970. 33 fig, 22 tab, 31 ref.

Descriptors: *Lakes, *Carbon, *Sulfur, Temperature, Oxygen, Phytoplankton, Zooplankton, Bacteria, Turnovers, Sulfur bacteria, Distribution, Laboratory tests, Primary productivity, Photosynthesis, Migration, Chemical properties.
Identifiers: *Sulfur-carbon turnover, Meromictic lakes, Redox potential, Carbon assimilation, Susljaev's sampler, Volga Region (USSR), Vertical distribution.

This voluminous report is primarily concerned with sulphur-cycle organisms of three meromictic lakes of northern Russia. Investigations of lake profiles included temperature, oxygen concentration, redox potential, and transformations of sulphur compounds. The survey recorded the distribution of phytoplankton, zooplankton, and sulphur bacteria. A part of the study was devoted to laboratory observations of the chemical and biological oxidation of sulphides as far as these processes are related to the chemo-autotrophic cycle of the investigated meromictic lakes. The results showed that oxidation of hydrogen sulphide provides an additional source of primary production in the form of bacteria consumed by zooplankton. (Wilde-Wisconsin)
W71-00677

STREAM OF ENERGY IN THE ECOSYSTEM OF AN EUTROPHIC LAKE (IN RUSSIAN),
Akademiya Nauk SSSR. Zoologicheskii Institut.
G. G. Vinberg.
Doklady Academy of Sciences of USSR, Vol 186, No 1, p 198-201, 1969. 1 tab.

Descriptors: *Lakes, *Energy, *Energy equation, Biomass, Phytoplankton, Zooplankton, Benthos, Fish, Nutrients, Primary productivity, Correlation analysis, Mathematical studies, Ecosystems.
Identifiers: Food consumption, Food assimilation, Lake Driviaty (Belorussia).

This ecosystematic survey of the 3000-hectare eutrophic lake included determinations of primary production, phytoplankton, zooplankton, zoobenthos, and population as well as fish nutrition. Each component of the ecosystem was appraised in terms of its biomass (B), production (P), catabolism (T), loss of energy in exchange and assimilation of food (A—T..P), consumption of food (R), and the corresponding rations P/B, T/B, and P/A. For a population having a constant biomass, the coefficient P/B expresses the 'turnover rate,' whereas the value B/P--the 'turnover time.' Both oxygen consumption method and solution of the equation rendered similar T values. The fish consumed during the summer 2.65% of the total supply of energy; the annual harvest of fish constituted only 0.14% of the total primary production. (Wilde-Wisconsin)
W71-00678

TROPHIC NATURE OF SELECTED WISCONSIN LAKES,
Wisconsin Dept. of Natural Resources, Madison. Div. of Environmental Protection.
Lloyd A. Lueschow, James M. Helm, Donald R. Winter, and Gary W. Karl.
Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Vol 48, p 237-264, 1970. 3 fig, 5 tab, 5 ref.

Descriptors: *Wisconsin, *Lakes, *Eutrophication, Oligotrophic, Sampling, Water quality, Phosphorus, Rooted aquatic plants, Chara, Weed control, Size, Depth, Hydrogen ion concentration, Hardness (Water), Alkalinity, Plankton, Nitrogen, Temperature, Dissolved oxygen, Hypolimnion, Light penetration, Zooplankton, Diatoms, Cyanophyta, Copper sulfate, Chlorophyta, Chlorella, Epilimnion.
Identifiers: Inorganic debris, Flagellates, Volatile solids.

Several water quality parameters of 12 Wisconsi lakes were evaluated. Parameters selected include nitrogen and phosphorus, temperature, dissolve oxygen, water transparency, and plankton analysis The lakes are ranked on annual means of the fiv parameters. Presence of dissolved oxygen in th hypolimnion during summer stagnation has an im portant effect on fish, but can be misleading as trophic index since the volume of the hypolimnio tempers the effect of production and decompos tion. Plankton samples collected did not fully me sure the standing crop of organic production sinc rooted or attached growths were ignored, and sma algal cells may pass through nets. Diatoms ar zooplankton did not develop nuisance conditions any of the lakes. Monthly analysis for organ nitrogen produced a ranking that was reasonab consistent with transparency, plankton, and recre tional potential; analyses for soluble phosphor had a coefficient of variation approaching 100 indicating samples were inadequate for reliab confidence interval about a mean; analysis for to phosphorus gave figures suggesting which lak would be essentially free of aquatic nuisances a which would experience nuisance weed growths algal blooms during most of the growing seaso (Jones-Wisconsin)
W71-00682

PRIMARY PRODUCTIVITY, CHEMO-O GANOTHROPHY, AND NUTRITIONAL I TERACTIONS OF EPIPHYTIC ALGAE A BACTERIA ON MACROPHYTES IN THE L TORAL OF A LAKE,
Michigan State Univ., East Lansing. Dept. Botany and Plant Pathology.
Harold LeRoy Allen.
Available from NTIS as COO-1599-25 (Pt. $3.00 in paper copy, $0.95 in microfiche. 19 186 p. Ph D Thesis.

Descriptors: *Lakes, *Productivity, Michig *Epiphytology, Nutrients, Plant pathology, *Alg Identifiers: Lawrence Lake (Michiga *Macrophytes.

Assessment of epiphytic algal and bacterial in community metabolism, and physiological-nu tional interrelationships of macrophyte-epiph systems, were investigated in the littoral zone small temperate lake from April 1968 through 1969. Annual primary productivity, chemo ganotrophic utilization of dissolved organic c pounds, and field and laboratory studies macrophyte-epiphyte interactions were monito by carbon-14 techniques. Qualitative and quan tive photosynthetic pigment composition, an brief taxonomic examination of the sessile c plex, accompanied measurement of field para ters. Productivity measurements of epiphytic a on artificial substrata colonized in emergent (S pus acutus Muhl.) and submergent (Najas fle L. and Chara spp.) macrophytic vegetation were compared over an annual period with pigm (chlorophyll a and total plant carotenoids) mates of biomass.
W71-00832

A PRELIMINARY INVESTIGATION SUSPENDED SEDIMENTS IN KAINJI LA NIGERIA,
Ife Univ. (Nigeria).

or primary bibliographic entry see Field 02J.
V71-00857

HARACTERISTICS OF THE TEMPERATURE ND VELOCITY REGIME OF BRATSK RESER-OIR UNDER AN ICE COVER,
entral Inst. of Weather Forecasting, Moscow USSR).
N. Bulatov.
rans. of Trudy TsIP, No 151, 1966. Soviet ydrology: Selected Papers No 3, 1966, p 262-276. ig, 5 tab, 4 ref.

escriptors: *Thermocline, *Heat balance, Reservoirs, Lakes, Currents (Water), Thermal operties, Cooling water, Temperature, Cooling, ater temperature, Heat flow, Thermal stratifica-n, Temperature gradients, Ice, Ice-water inter-ces, Lake ice.

he interrelationship between the vertical water mperature and current velocity distributions der an ice cover in cross sections in various parts the Bratsk Reservoir are described. The ther-ocline was found also under ice conditions. The ermocline is usually several meters thick and oothly merges with the overlying and underlying ers. The heat exchange coefficient varies with pth. No thermocline forms under the ice cover of kes and reservoirs, in the absence of a current. so it is not observed in through-flow, but shallow servoirs. The description of the formation of a ermocline in the reservoir is presented. The eory was developed according to the heat lance . Computations for the reservoir were per-rmed, and a working equation has been oposed. (Novotny-Vanderbilt)
71-00916

EAT TRANSFER COEFFICIENT IN WATER ODIES WITH LIMITED FLOWAGE DURING MMER HEATING,
te Hydrological Inst., Leningrad (USSR).
I. Rossinskiy, and M. P. Kravtsova.
ans. of Trudy GGI, No 162, 1969. Soviet drology: Selected Paper, No 1, 1969, p 27-38. 2 , 5 fig, 5 ref.

scriptors: *Transfer, Heat, Thermal properties, kes, Reservoirs, Reservoir stages, *Thermal atification, Impounded waters, Heat budget, ermocline, Gradient, Epilimnion.
ntifiers: Heat transfer coefficients.

contrast to small turbulent bodies of water, hin which the basic heat transfer agent oughout the year is turbulent water flow, in the ters of deep water bodies heat transfer occurs ring different seasons and in different parts of water bodies under the influence of different tors. Accordingly, six periods were defined with ferent heat transfer patterns in the water layers deep lakes and reservoirs, and the vertical and izontal temperature distributions were ex-ined. It was found that the test heat conductivity fficients were not uniform over the depth and gth of reservoirs. For a stationary regime the o of the heat conductivity coefficients is inver-y proportional to the temperature gradients of bounding layers. The degree of nonuniformity eat exchange between a water body and the at-sphere is proportional to its mean intensity. The ults and observations of several lakes are sented. (Novotny-Vanderbilt)
1-00917

SSOLVED OXYGEN VARIATIONS IN RATIFIED LAKES,
gon State Univ., Corvallis.
id A. Bella.
rnal of the Sanitary Engineering Division, ceedings of the ASCE, Vol 96, No SA5, Paper 8, p 1129-1146, Oct 1970. 11 fig, 15 ref.

scriptors: *Stratification, *Temperature, *Ox-n, Lakes, Dissolved, Mixing, Reaeration, Reser-s, Algae, Hypolimnion, Mathematical models, pth, Respiration, Washington.
Identifiers: Vertical dispersion coefficient, Lake Sammamish (Washington).

A mathematical model describing the dissolved oxygen variations in a stratified lake is developed. The model is one dimensional and includes dissolved oxygen variation with depth and time. The model describes the combined effect of reaeration, photosynthetic oxygenation, vertical mixing and oxygen uptake. A method for estimating hypolimnetic oxygen demands in stratified lakes was presented and used for analysis of data from Lake Sammamish, Washington. The possibility that the hypolimnetic DO depletion during summer months in Lake Sammamish was largely due to benthal oxygen demand was investigated and analysed. A series of model computations using finite-difference methods demonstrates that hypolimnetic oxygen levels within stratified lakes were more sensitive to both vertical mixing and hypolimnetic respiration to either photosynethetic oxygenation or reaeration. (Upadhyaya-Vanderbilt)
W71-00978

EFFECTS OF ORGANIC ACIDS ON THE FLOCCULATION OF SUSPENDED SEDIMENTS IN TROPICAL MAN-MADE LAKES,
Ife Univ. (Nigeria).
L. Olayinka Asseez.
Journal of Hydrology, Vol 11, No 3, p 253-257, September 1970. 5 p, 1 fig, 1 tab, 1 ref.

Descriptors: *Organic acids, *Flocculation, *Deposition (Sediments), *Suspended load, *Reservoir silting, Sediment yield, Sedimentation, Dispersion, Sampling, Sediment control.
Identifiers: Kainji Lake (Nigeria).

Thirty-five suspended sediment samples from Kainji Lake, Nigeria were studied to determine the effect of dispersion on the natural particle size distribution in the natural water. The rapid rate of decay of the submerged plants released a copious amount of humic acids which served as strong flocculants, and this has an important effect on the settling rate of suspended sediments, particularly in tropical lakes. This decay was highest in the Foge Island area, which was submerged three days after the gates of the dam had been closed. Considering deposition in stagnant waters, flocculation arising from decaying organic matter may be as important as reduction in velocity. The rate of sedimentation within a reservoir can be estimated from data on volume and thickness of sediments deposited during a given period. If flocculation arising from decay of organic matter is high during the first few years, a later comparable rate of deposition cannot be assumed even when all other conditions remain constant. (Knapp-USGS)
W71-01062

2I. Water in Plants

EFFECTS OF STEMFLOW WATER ON A MIAMI SOIL UNDER A BEECH TREE: I. MORPHOLOGICAL AND PHYSICAL PROPERTIES,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 02G.
W71-00554

EFFECTS OF STEMFLOW WATER ON A MIAMI SOIL UNDER A BEECH TREE: II. CHEMICAL PROPERTIES,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 02G.
W71-00555

LEACHING OF CROP RESIDUES AS A SOURCE OF NUTRIENTS IN SURFACE RUNOFF WATER,
Agricultural Research Service, Morris, Minn.; and Minnesota Univ., Morris.
For primary bibliographic entry see Field 05B.
W71-00584

EXTRACTION TERM MODELS OF SOIL MOISTURE USE BY TRANSPIRING PLANTS,
Stanford Univ., California.
F. J. Molz, and Irwin Remson.
Water Resources Research, Vol 6, No 5, p 1346-1356, October 1970. 11 p, 6 fig, 1 tab, 18 ref.

Descriptors: *Soil-water-plant relationships, *Transpiration, *Soil water movement, *Moisture uptake, *Root systems, Velocity, Unsaturated flow, Mathematical models, Respiration, Translocation, Soil moisture, Flow, Hydraulic conductivity, Moisture content, Moisture availability, Water utilization, Root zone.
Identifiers: Soil water extraction.

A mathematical model is developed describing moisture removal from soil by the roots of transpiring plants. The model uses a macroscopic extraction term in the one-dimensional soil moisture flow equation. It describes both moisture removal by the plant and induced moisture movement through the soil. A numerical procedure based on the Douglas-Jones predictor-corrector method is used to solve the model, and solutions are compared with experimental data. The results indicate that extraction term models are computationally and physically feasible and give insight into the mechanics of the overall moisture extraction process. (Knapp-USGS)
W71-00586

EFFECT OF VARIOUS SALINITY REGIMES ON GROWTH, LEAF EXPANSION AND TRANSPIRATION RATE OF BEAN PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcano Institute of Agricultural Research; and Hebrew Univ. of Jerusalem (Israel).
For primary bibliographic entry see Field 03C.
W71-00685

PROPERTIES OF DEEP SANDY SOILS AND THE GROWTH OF LOVEGRASS, ERAGROSTIS CURVULA (SCHRAD.) NEES,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia).
For primary bibliographic entry see Field 02G.
W71-00686

HEAVY PRECIPITATION INFLUENCES SALINE CLAY FLAT VEGETATION,
Texas A and M Univ., College Station. Dept. of Range Science.
P. E. Buckley, and J. D. Dodd.
Journal of Range Management, Vol 22, No 6, p 405-407, June 1969. 2 fig, 2 tab, 8 ref.

Descriptors: *Range grasses, *Arid lands, *Precipitation (Atmospheric), *Vegetation, *Productivity, Texas, Xerophytes, Moisture stress, Biomass, Ranges, Grama grasses, Forage grasses, Clay minerals, Ecology, Hurricanes, Brush, Grasses, Density, Plant populations, Salts.
Identifiers: *Rio Grande Plains (Texas).

The saline, clay soils of the Rio Grande Plains, Texas, are considered drought-prone because of high salt content, low rainfall and high evaporation. Owing to past overgrazing, many grass species have decreased or disappeared and the area has been invaded by xeric shrubs. A vegetational analysis of a study area was performed after it had been closed to grazing for 5 years. Only 4 grass species were identified and their heights were below 2 inches. Plant densities ranged from 2500-66,000 per acre and herbage production was not measurable. Three months later after a hurricane (Beulah) had resulted in a 13 inch rainfall increase, the area was again surveyed. A large influx of annual and short-lived perennial grasses had changed plant composition, densities and yield. Densities ranged from 400,000-1,000,000 plants/acre and mean production ranged from 731.7-1743.7 lbs/acre. Production of these short-lived grasses provided a suitable

microenvironment for establishment of more suitable grasses. (Casey-Arizona)
W71-00687

MICROBIOLOGICAL PROBLEMS IN THE ARID ZONE OF WEST PAKISTAN,
University of the Punjab, Lahore (Pakistan). Dept. of Zoology.
Rafat H. Jafri.
Pakistan Journal of Science, Vol 20, No 5 and 6, p 308-312, September-November 1968. 32 ref.

Descriptors: *Arid lands, *Microbiology, *Nitrogen fixing bacteria, *Decomposing organic matter, Public health, Ammonification, Diseases, Deserts, Winds, Sands, Semiarid climates, Microorganisms.
Identifiers: *Pakistan.

Nearly two-thirds of West Pakistan is arid. High temperatures, strong dessicating winds, flash floods and erratic rainfall are interacting factors contributing to the steady 1 mile per year advancement of the desert. It is estimated that about 200,000,000 acres of land could be brought into cultivation but so far only 45,000,000 acres are being farmed. Much work must be done in this arid zone if progress is to occur. The author feels that microbiological problems unique to the arid zone must be attacked. Areas suggested for study are: (1) Microorganisms involved in crop and timber diseases, (2) The ammonifying microflora of unploughed desert soils, (3) Nitrifying bacteria of the rhizophores of desert plants, (4) The microbial balance of areas soon to be newly irrigated, (5) Microbial decomposition of organic matter for fertilizer, (6) Food decay microorganisms, (7) The use of disease-producing microorganisms to control wild animal populations and (8) Public health. (Casey-Arizona)
W71-00689

INVASION OF MEDUSAHEAD INTO THE GREAT BASIN,
Agricultural Research Service, Reno, Nev. Crops Research Div.; and Nevada Agricultural Experiment Station, Reno.
James A. Young, and Raymond A. Evans.
Weed Science, Vol 18, No 1, p 89-97, January 1970. 3 fig, 6 tab, 37 ref.

Descriptors: *Weeds, *Great Basin, *Soil moisture, *Vegetation establishment, *Environmental effects, Arid lands, Semiarid climates, Oregon, California, Idaho, Nevada, Rainfall, Soil water, Water requirements, Invasion, Biological communities, Ranges, Sagebrush, Soil types, Clays, Weed control, Plant populations.
Identifiers: *Medusahead, *Annual plants, *Vertisols, *Site degradation.

Medusahead (Taeniatherum asperum (Sim.) Nevski), introduced into Oregon in the late 19th century, has successfully invaded the annual-dominated rangeland of northcentral California and spread into eastern Oregon and western Idaho. Infestations have reached the edge of the Great Basin along the northern California-Nevada border, with the plants found most commonly in clay soils, which have a high water-holding capacity. This preference is apparently due to medusahead's greater water needs when compared with other range annuals. Medusahead is more likely to invade vertisol sites populated by sparse native plant communities than more complex low sagebrush (Artemisia arbuscula Nutt.) or low sagebrush-woodland communities on similar clay soils. However, medusahead can invade and occupy these more complex communities if they are degraded to a low seral state. Plant communities in which big sagebrush (Artemisia tridentata Nutt.) is dominant and soil texture ranges from medium to coarse prove very resistant to medusahead invasion. Although medusahead might appear restricted to certain soil and vegetation assemblages, site degradation coupled with favorable fall and spring precipitation enhance its probability of becoming established. (Carr-Arizona)
W71-00693

NITROGEN AND PHOSPHORUS FERTILIZATION FOR PRODUCTION OF CRESTED WHEATGRASS AND NATIVE GRASS IN NORTHEASTERN MONTANA,
Agricultural Research Service, Bozeman, Mont. Northern Plains Branch; and Montana Agricultural Experiment Station, Bozeman.
A. L. Black.
Agronomy Journal, Vol 60, No 2, p 213-216, March-April 1968. 8 tab, 15 ref.

Descriptors: *Wheatgrasses, *Nitrogen, *Phosphorus, *Fertilization, *Soil water, Montana, Arid lands, Semiarid climates, Forage grasses, Forages, Fertilizers, Crop response, Crop production, Efficiencies, Range grasses, Range management, Grama grasses, Water utilization, Plant growth, Nutrients.
Identifiers: *Water-use efficiency.

A field of crested wheatgrass (Agropyron desertorum (Fisch.) Schult., 'Standard') and adjoining native rangeland was treated with N and N-P fertilizers during the years 1961-1964. Fertilization consistently increased forage yields on both sites, with the greatest response occurring the year of fertilization. Residual effects were present and significant 1 to 2 years later, however. Plant P content increased substantially when P was applied the first year and 3 years later, regardless of any N treatment. When N was applied at a rate of 45 kg/ha or greater, water-use efficiency of both grasses increased 1.5 to 2.5-fold for 2 or 3 years. This occurred regardless of P treatment. Increase in water-use efficiency appeared to be partially due to more efficient extraction of subsoil water. When N was applied alone at rates of 45 or 90 kg/ha over the 4-year study period, plant recovery of N averaged 65.8% for crested wheatgrass and over 60.0% for native grasses (Agropyron smithii Rydb., Stipa viridula Trin., and Bouteloua gracilis (H.B.H.) Lag.). However, when N and P were applied together recovery of N was greater (73.1%) for crested wheatgrass, but less (38.2%) for native grasses. N application increased crude protein production for both grasses. (Carr-Arizona)
W71-00695

RESTING ROOTS OF PINUS HALEPENSIS: STRUCTURE, FUNCTION, AND REACTION TO WATER STRESS,
Hebrew Univ., Jerusalem (Israel). Dept. of Plant Physiology.
B. Leshem.
Research grant No. 10-FS-7 from the Forest Service, U.S. Department of Agriculture. Botanical Gazette, Vol 131, No 2, p 99-104, June 1970. 7 fig, 2 tab, 25 ref.

Descriptors: *Pine trees, *Root systems, *Moisture stress, *Semiarid climates, *Soil-water-plant relationships, Soil moisture, Soil water, Water stress, Plant growth, Plant physiology, Phenols, Irrigation, Lignins.
Identifiers: *Aleppo pine, *Resting roots, *Israel, *Metacutization, Tissue, Apical meristem, Soil water potential.

Aleppo pine (Pinus halepensis Mill.), found in subhumid to semiarid Mediterranean regions, ceases most root growth as summer approaches. The roots enter a resting state in which metacutization occurs. This is a special chemical process of lignification and suberization taking place in the cortex and dormant root cap. Compared with growing roots, the meristematic region of the resting roots were greatly reduced and heterogeneous and were completely surrounded by the metacutis. Metacutization developed in the outer cells of the phenol-containing zones of the apical meristem, forming a layer between the meristematic and mature tissues. The metacutis was found to be of no value as a protective sheath. Metacutization could be induced by lowering soil water potential to -7 bars, but root growth resumes, even in dry summers, after irrigation. (Carr-Arizona)
W71-00697

HOMOCLIMES AND INTRODUCTION O TREES AND SHRUBS WITH SPECIA REFERENCE TO THE ARID AND SEMI-ARI ZONE OF INDIA,
Forest Research Inst., Dehra Dun (India). Coll. Forest Education; Central Arid Zone Researc Inst., Jodhpur (India). Div. of Resource Utilizatio Studies; and Andhra Univ., Waltair (India). Dep of Meteorology and Oceanography.
R. C. Kaushik, R. N. Kaul, and V. P. Subrahmanyam.
Indian Forester, Vol 95, No 5, p 283-292, Ma 1969. 2 tab, 26 ref.

Descriptors: *Evapotranspiration, *Forests, *Ar lands, *Climatic zones, *Climatic data, Temper ture, Heat balance, Water balance, Semiarid c mates, Trees, Shrubs, Zerophytes, Vegetati establishment.
Identifiers: *Introduced plants, *Potenti evapotranspiration, *Climatic classificatio *Homoclimes, *India, Megathermals.

Some theories on the nature of correlatio between vegetation zones and climatic factors a briefly reviewed and 2 systems of climatic classi cation are discussed in some detail. Koppe system recognized the inadequacy of identifyi climatic regions by temperature and rainfall da but failed to evaluate adequately the heat factor climate. Thornthwaite's system utilized a cent parameter-potential evapotranspiration, whi because of its dependence on energy balan serves as both a moisture and a temperature ind It is recognized that seasonal variation of effect moisture has a profound influence in the develo ment of climatic climaxes in the evolution vegetation. In discussing the introduction of t and shrub species into arid and semiarid zones, i therefore important to match climatic factors fr various parts of the world where the introduc species are native. Accompanying tables list va ties of tree and shrub species which mi profitably be introduced into Indian arid regi and corresponding world homoclimes. (Cas Arizona)
W71-00699

SOIL MOISTURE EFFECTS ON COMPETITI ABILITY OF WEEDS,
Southwestern Great Plains Research Cen Bushland, Tex.
For primary bibliographic entry see Field 02G.
W71-00701

IRRIGATION STUDIES ON COTTON: II. BO WEIGHT AND FIBRE PROPERTIES,
Central Arid Zone Research Inst., Jodhpur (Ind
For primary bibliographic entry see Field 03F.
W71-00703

IRRIGATION STUDIES ON COTTON IN A ZONE: I. EFFECT OF VARIOUS METHODS IRRIGATION AND LEVELS OF S MOISTURE ON GROWTH AND YIELD THREE VARIETIES OF COTTON,
Central Arid Zone Research Inst., Jodhpur (Ind
For primary bibliographic entry see Field 03F.
W71-00704

ADHESIVE HYDROCOLIOIDS SECRETED MICROSCOPIC MARINE ALGAE,
Naval Civil Engineering Lab., Port Hueneme, C
Harold P. Vind.
Available from NTIS as AD-867 080, $3.0 paper copy, $0.95 in microfiche. February 1 46 p. Technical Note N-1077.
Identifiers: *Fouling, Algae, *Algae, Adhe *Adhesives, Secretion, Gels, Proteins, Polyn Polysaccharides, Alginic acid, Marine biology, loids, Spectra (Infrared), *Hydrocolloids, rageen.

The adhesion of microscopic marine algae t walls of small containers of sea water has been died. Infrared spectra of extracts and films of

were analyzed and compared to spectra of known hydrocolloids. The studies indicate that the gels holding algae together in films are composed primarily of polysaccharide polymers similar to the seaweed hydrocolloids, carrageenan and alginic acid, but that the adhering layer of substance joining algae to foreign surfaces is mostly protein. Like all proteins in their native states, it is also a hydrocolloidal gel. Recognition that adhesive systems of marine fouling organisms are hydrocolloidal gels tells a great deal about their nature and delineates the most logical areas in which to undertake research on methods to prevent attachment of fouling organisms.
W71-00817

INTERCEPTION OF PRECIPITATION BY VEGETATION,
Forest Service (USDA), Franklin, N.C. Southeastern Forest Experiment Station.
J. D. Helvey.
In: Representative and Experimental Basins, An International Guide for Research and Practice, UNESCO Studies and Reports in Hydrology 4, 1970, p 89-92.

Descriptors: *Interception, *Rainfall, *Throughfall, *Stemflow, *Design criteria, Instrumentation, Measurement, Reliability, Statistical methods, Watershed management, North Carolina.
Identifiers: Net rainfall, Litter interception.

Guidelines are presented for designing studies of rainfall interception loss in forest stands. The spatial variability of each interception parameter is used to determine the size of the gaging network necessary to achieve a desired sample accuracy. (Helvey-Forest Service)
W71-00915

WATER BALANCE IN THE WHIPSCORPION, MASTIGOPROCTUS GIGANTEUS (LUCAS) (ARACHNIDA, UROPYGI),
Arizona State Univ., Tempe. Dept. of Zoology.
Gregory A. Ahearn.
Comparative Biochemistry and Physiology, Vol 35, No 2, p 339-353, 15 July 1970. 6 fig, 2 tab, 49 ref.

Descriptors: *Water balance, *Water loss, *Cuticle, *Animal physiology, Invertebrates, Respiration, Arizona, Temperature, Humidity, Arid lands, Transpiration, Weight, Environmental effects, Absorption, Xerophilic animals.
Identifiers: *Arachnida, *Whipscorpion, *Terrestrial arthropod water balance, Oxygen consumption, Arthropod transpiration, Integument, Cuticular water loss, Dessication.

Studies on rates of water loss in arachnids have indicated differences between temperate and desert forms. In specimens of an Arizona mesic form, the whipscorpion, measured water loss under controlled environmental conditions near zero percent relative humidity was exponentially related to weight with the heavier animals losing the least. With temperature ranging over 20-40 degrees centigrade, rates of transpiratory water loss (integumentary and respiratory components) increased gradually to 37.5 degrees and suddenly elevated 3-fold. This probably represented breakdown of a waterproof cuticle since water loss rates above 37.5 degrees were much greater than increases in oxygen consumption. At high relative humidities water loss was low but became linear with time at lower levels. Animals between 0.1-2.0 grams on saturated sponges recovered large proportions of water lost by predessication within 2 hours while larger specimens gained nothing. Apparently water uptake from moist substrates is active, involving drinking and possibly cuticular absorption. Comparisons with data on xeric arachnids indicates there may be an order of magnitude difference in water loss between xeric and mesic forms, the loss being greater in mesic forms. (Casey-Arizona)
W71-00948

THE WATER ECONOMY OF THE SAGE SPARROW, AMPHISPIZA BELLI NEVADENSIS,
Oregon State Univ., Corvallis. Dept. of Zoology.
Ralph R. Moldenhauer, and John A. Wiens.
Supported by the National Science Foundation (Grant GB-6606). Condor, Vol 72, No 3, p 265-275, July 1970. 5 tab, 2 fig, 29 ref.

Descriptors: *Birds, *Xerophilic animals, *Ecology, *Animal behavior, *Water conservation, Arid lands, Moisture stress, Osmotic pressure, Animal physiology, On-site investigations, Laboratory tests, Saline water, Water loss, Water requirements, Water balance, Thermal stress, Weight.
Identifiers: *Succulents, Sage Sparrows.

Physiological and behavioral studies were undertaken to determine any adaptations peculiar to desert life in the xerophilic Sage Sparrow. Normal ad libitum water intake in captive birds was about 100 percent body weight per day and fecal drop moisture content was about 76 percent. Restricted to succulents, normal body weight was maintained on lettuce (95 percent water) and Tenebrio larvae (60 percent), and fecal water content was about 66 percent. When confined to a dry diet without water, motor activity increased, food intake decreased, gradual weight loss occurred and the birds died in 8 days. Two factors determine a bird's ability to survive on saline water: (1) Tolerance of high blood osmotic pressures (2) Renal concentration capacity. In both, Sage Sparrows are unexceptional. Individuals lost weight on NaCl drinking solutions of 0.25 molar or more and maximum urine-plasma chloride ion ratio was 2.4. Field studies showed that breeding birds satisfied their summer water demands by eating succulent vegetation and insects. Behavioral responses lead to avoidance of heat stress with consequent body water conservation. This compensates for the lack of any unique physiological water conservation mechanisms. (Casey-Arizona)
W71-00949

THE STATUS OF SUMMER ANNUALS IN PALESTINE,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
M. Negbi.
Israil Journal of Botany, Vol 17, No 4, p 217-221, 1968. 1 tab, 20 ref.

Descriptors: *Desert plants, *Soil moisture, *Arid lands, *Deserts, *Environment, Habitats, Summer, Semiarid climates, Plant physiology, Germination, Seeds, Migration, Ecological distribution.
Identifiers: *Summer annuals, *Israel, *Central Asia, *Near East, *Adaptation, Seedlings.

A habitat study of summer annuals in Israel reveals that 45 per cent of the plants grow in dry habitats where winter rainwater is stored in the soil for summer use. Dispersal, germination, and seedling establishment of five desert annuals (Salsola inermis Forssk., Salsola volkensii Schweinf. et Aschers., Salsola kali L., Aellenia autrani (Post) Zoh., and Kochia indica Wight) are discussed in order to illustrate their adaptation to their arid environment. Based on a study of migration and distribution of Kochia indica and Salsola kali, the author presents a hypothesis for the Central Asiatic origin of summer annuals endemic to the Near Eastern deserts. (Carr-Arizona)
W71-00950

THE VEGETATION OF SARATOGA SPRINGS, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA,
Nevada Southern Univ., Las Vegas. Dept. of Biological Sciences.
W. Glenn Bradley.
U.S. National Park Service Contract No 14-10-0434-1989. Southwestern Naturalist, Vol 15, No 1, p 111-129, June 1, 1970. 4 fig, 7 tab, 12 ref.

Descriptors: *Xerophytes, *Phreatophyes, *Marsh plants, *Plant populations, *Environmental gradient, Arid lands, California, On-site investigations, Halophytes, Saline soils, Standing crop, Water demand, Sampling, Vegetation, Distribution patterns, Frequency, Salt marshes.
Identifiers: *Species diversity, *Death Valley, Plant cover, Plant communities, Perennial.

A study was made of the perennial vegetation of a spring-fed salt marsh and its adjacent environment. The vegetation of the area forms a mosaic of plant communities with sharp boundaries. Three major vegetation types occur--xeric shrub, phreatophyte and salt marsh. The species and distributions of each are described. In species diversity, the xeric shrub communities are depauperate, reflecting the harsh physical conditions under which they survive. The phreatophyte communities are more diverse and occur in areas where the water table is high. The standing crops of all 3 communities were estimated and the value for the salt marsh community was by far the greatest. This was reflected in a comparison of the communities along a moisture gradient in which the salt marsh community also had the greatest number of perennial species and percent of cover. Salinity gradients and water gradients are apparently the crucial factors in vegetation distribution and are responsible for the sharp boundaries of the community mosaic. (Casey-Arizona)
W71-00953

FIELD STUDIES ON THE SANDGROUSE OF THE KALAHARI DESERT,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Zoology.
Gordon L. Maclean.
Supported by U.S. Public Health Service Grant ES 00008 (Environmental Health). In: The Living Bird-7th Annual of the Cornell Laboratory of Ornithology, p 209-235, 1968. 17 fig, 1 tab, 45 ref.

Descriptors: *Birds, *Ecology, *Arid lands, *Temperature, *Regulation, *Water requirements, Breeding, Calcareous soils, Dunes, Semiarid climates, Seeds, Surface waters, On-site investigations, Saline water, Habitats, Dry seasons, Cooling, Animal physiology.
Identifiers: *Africa, *Kalahari Desert, *Gular fluttering, *Sandgrouse.

The Namaqua Sandgrouse (Pterocles namaqua live in shrubby calcrete along river banks while the Spotted Sandgrouse (P. burchelli) live in the grassy dunes of the Kalahari Desert. Both species capitalize on the most abundant food in deserts-dry seeds. Unlike insectivorous birds, however, they are dependent upon free surface water and must often travel long distances for it. A 100-mile round trip is a probable maximum breeding range. Drinking is usually done in flocks at consistent morning hours. Gular fluttering is the sole physiological cooling mechanism and appears to be highly efficient. Behavioral cooling and breeding mechanisms are described. Only the breeding habits of manaque have been observed, and it may breed at any time of the year but usually does so during the dry season. The male wets his breast feathers at a pond and flies to the young, supplying them with water. These species may be affected by the increases of waterholes due to human activities. (Casey-Arizona)
W71-00954

THE NOCTURNAL BEHAVIOUR OF XEROPHYTES GROWN UNDER ARID CONDITIONS,
Colorado State Univ., Fort Collins. Dept. of Watershed Resources.
I. Gindel.
New Phytologist, Vol 69, No 2, p 399-404, April 1970. 2 tab, 25 ref.

Descriptors: *Transpiration control, *Stomata, *Xerophytes, *Arid lands, *Soil-water-plant relationships, Moisture deficit, Dew, Humidity, Field capacity, Wilting point, Plant physiology, Plant groupings, Laboratory tests, Leaves, Nocturnal, Diurnal, Hydrogen ion concentration, Alfalfa.
Identifiers: *Relative humidity, Eucalyptus.

Nighttime leaf stomatal closure has long been thought universal in plants and a result of increased guard cell pH due to carbon dioxide accumulation. The stomatal apertures of 78 indigenous and introduced woody xerophytes grown under arid, water deficient conditions were measured in the dark and in daylight. As a percentage of total leaf area, stomatal openings were 0.017-0.122 during the day and 0.155-0.471 at night. Openings were evident during nights with dew and high relative humidity but not when relative humidity dropped to 30-40 percent. Four species (alfalfa and 3 Eucalyptus species) were pot-grown in 2 groups, one at wilting point and the other at field capacity. A much greater percentage of stomatal openings occurred in the moisture deficit group. Apparently stomatal opening in xeromorphic plants is strongly influenced by water deficit. (Casey-Arizona)
W71-00955

THE EFFECT OF NITROGEN SUPPLY ON TRANSPIRATION AND STOMATAL BEHAVIOUR OF BEANS (PHASEOLUS VULGARIS L.),
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 02D.
W71-00956

THE EFFECT OF NITROGEN SUPPLY ON SOME INDICES OF PLANT-WATER RELATIONS OF BEANS (PHASEOLUS VULGARIS L.),
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 02D.
W71-00957

IRRIGATED CASTORBEAN, SOYBEAN, AND SAFFLOWER TRIALS AT THE NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
David H. Williams.
March 1968, 12 p, 13 tab. Research Report 133.

Descriptors: *Irrigation effects, *Crop production, *Plant growth, *New Mexico, Disease resistance, Soybeans, Arid lands, Leaves, Plant pathology, On-site tests, Seeds, Data collections, Seeds, Climatic data.
Identifiers: *Castorbeans, *Safflower, Tucumcari (New Mexico), Commercial production, Leaf disease, Root disease, Seed shattering, Trials, Hulling.

Irrigated variety trials of castorbeans, soybeans and safflower were conducted at the Northeastern Branch Station, Tucumcari, New Mexico. Materials, methods and results are discussed for each crop. This study was undertaken because local producers expressed interest in finding crops to supplement sorghum and alfalfa. Tables include data on yields, hulling percentages, height, shattering, date of 10-percent flowering (safflower), cultural practices, climatic conditions and disease damage (safflower) for castorbean (1953-1962), soybean (1955-1964) trials. Castorbean yields indicate the crop is well adapted for commercial production in this area. No variety, strain or hybrid consistently produced outstandingly high yields. Baker 296 is the only tested variety which should not be grown due to leaf-disease susceptibility. Seed shattering was a major problem in the soybean trials. Lee was the only variety which exhibited a high and prolonged shatter resistance. Favorable yields were obtained, showing Lee is adapted for production in this area. Safflower should not be grown under irrigation here because of severe root disease. (Popkin-Arizona)
W71-00964

WATERFOWL - WATER TEMPERATURE RELATIONS IN WINTER,
Colorado State Univ., Fort Collins. Natural Resources Center.
Ronald A. Ryder.
Available from NTIS as PB-195 612, $3.00 in paper copy, $0.95 in microfiche. Colorado State University Environmental Resources Center Completion Report Series No 21, June 30, 1970. 60 p, 53 fig, 11 tab, 10 ref. OWRR A-006-COLO (3).

Descriptors: *Water temperature, *Climates, *Ducks (Wild), *Overwintering sites, Aquatic life, Waterfowl, Environment, Aquatic environment, Aquatic habitats, Wildlife habitats, Cold regions, Migration patterns, Migratory birds.
Identifiers: Water temperature - wildfowl relations.

A study was conducted in Larimer County, Colorado, 1967-70, to investigate the ability of waterfowl to winter north of the 0 degree C isotherm. Ground and aerial counts were made of selected duck and goose concentration areas where waterfowl maintained patches of open water. The number of birds using an area and the size of the area were estimated from aerial photographs. The area of open water per bird and ambient temperature appear to be directly related. Ten 3-hour experiments were conducted with captive, wild Mallards in a controlled temperature, cold room to determine the effect of ducks on low water temperatures. Ducks under test conditions produced significantly more heat than ducks under control conditions. The test condition metabolism represented an increase of 22.7 percent over the control metabolism. Nocturnal behavior of Redhead ducks on a pond was observed during freezing weather. Activity was greater at night during freezing weather than during warmer weather. Duck defecation rates and chemical content of feces were determined from captive ducks. (Knapp-USGS)
W71-01054

2J. Erosion and Sedimentation

DETACHMENT OF SOIL AGGREGATES BY SIMULATED RAINFALL,
Nebraska Univ., Lincoln. Dept. of Agronomy.
Andrew P. Mazurak, and Peter N. Mosher.
Soil Science Society of America Proceedings, Vol 34, No 5, p 798-800, September-October 1970. 3 p, 3 fig, 1 tab, 7 ref.

Descriptors: *Soil erosion, *Soil amendments, *Impact (Rainfall), Soil structure, Soil stability, Soil management, Soil stabilization, Soil texture, Puddling, Rainfall simulators, Soil surfaces.
Identifiers: Clod strength.

Detachment of naturally occurring soil aggregates when exposed to simulated rainfall increased from 76 mg of particles per cc of water to a maximum amount of 172 mg/cc as the diameters of aggregates decreased from 9,250-4,760 microns to 2,360-1,680 microns. Then, the amount of splashed soil particles decreased as the diameter of aggregate decreased. Addition of Krilium to aggregates reduced the amount of splash for aggregate fractions larger than 420 microns in diameter but increased the amount for fractions smaller than 420 microns in diameter. (Knapp-USGS)
W71-00556

STABILITY OF A SAND BED SUBJECTED TO A SHEAR FLOW OF LOW FROUDE NUMBER,
Washington Univ., Seattle. Dept. of Oceanography.
J. Dungan Smith.
Journal of Geophysical Research, Vol 75, No 30, p 5928-5940, October 20, 1970. 13 p, 10 fig, 1 tab, 18 ref. AEC Contract AT (45-1)-1752 (ref. RL0-1752-9).

Descriptors: *Sediment transport, *Bed load, *Shear drag, *Froude number, *Sand waves, Dunes, Ripple marks, Critical flow, Transition flow, Velocity, Turbulent flow, Open channel flow, Alluvial channels, Sands, Viscosity, Hydraulics, Hydrodynamics, Sedimentary structures.
Identifiers: Sand-bed stability, *Shear flow.

The problem of sand bed stability is formulated and solved for a model in which the local slope of the free surface is small relative to the slope of the perturbed lower boundary. The solution shows the bed to be unstable to perturbations of wavelength greater than the wavelengths for which the inertia of the sediment grains is important. Wave speeds and growth rates from numerical calculations are presented and compared with long- and short-wave asymptotic expressions. Although the fluctuating velocity field in the nonuniform flow is approximated by a constant eddy viscosity, a general picture of the relationship between the flow over a perturbed boundary and the observed geometrical and dynamical parameters of the resulting boundary waves can be developed. It is shown that the sand bed instability is due to local accelerations of a shear flow caused by the nonuniform boundary. If either the shear or the acceleration is eliminated from the analysis, the instability cannot be found. On the other hand, no wavelength is defined by such an analysis, and it is shown that the wavelength is determined by spatial adjustments in the turbulent velocity field. (Knapp-USGS)
W71-00560

LONGSHORE SAND TRANSPORT ON BEACHES,
Scripps Institution of Oceanography, La Jolla, Calif.
Paul D. Komar, and Douglas L. Inman.
Journal of Geophysical Research, Vol 75, No 30, p 5914-5927, October 20, 1970. 14 p, 9 fig, 2 tab, 30 ref.

Descriptors: *Sediment transport, *Beaches, *Littoral drift, *Mathematical models, Shores, Surf, Waves (Water), Currents (Water), Sands, Model studies, Bed load, Sand waves, Tractive forces.
Identifiers: Longshore currents.

Simultaneous field measurements of wave and current parameters in the surf zone and the resulting longshore transport of sand were made on two beaches under a variety of conditions. The direction and flux of wave energy was measured from an array of digital wave sensors placed in and near the surf zone. Quantitative measurements of the longshore sand transport rate were obtained from the time history of the center of gravity of sand tracer. The measurements were used to test two models for the prediction of the longshore transport rate of sand. The first model gives the immersed weight longshore transport rate of sand as proportional to the longshore component of wave energy flux. The second model assumes that the waves provide the power to move and support the sand and that the superimposed longshore current provides a longshore component that results in the longshore transport of sand. Both models successfully predict the sand transport rate. The coherence of the models appears to be based on the generation of the longshore currents by the longshore radiation stress. The models will not be equivalent if the longshore current owes its origin to some other generating mechanism such as tides or winds. (Knapp-USGS)
W71-00561

AN IMPROVED METHOD FOR SIZE DISTRIBUTION OF STREAM BED GRAVEL,
Geological Survey, Washington, D.C.
Luna B. Leopold.
Water Resources Research, Vol 6, No 5, p 1357-1366, October 1970. 10 p, 6 fig, 3 tab, 10 ref.

Descriptors: *Sampling, *Gravels, *Particle size, *Statistical methods, Dimensions, Weight, Surveys, Reliability, Statistics, Data collections, Measurement, Alluvial channels, Sediment transport.
Identifiers: Sediment sampling.

Random sampling of surface rocks on a gravel bar is biased toward larger sizes which, because of their area, are more likely to be picked up. Weighting can eliminate this bias. Data on average weight of a single rock are used to change numbers of rocks to weights, thus yielding size frequency data in

general agreement with a sieved and weighed sample. The question of what to sample depends on the use to which the data are to be put, and is treated only briefly. (Knapp-USGS)
W71-00585

THE MEASUREMENT OF THE EFFECTS OF BUILDING CONSTRUCTION ON DRAINAGE BASIN DYNAMICS,
Exeter Univ. (England).
For primary bibliographic entry see Field 04C.
W71-00592

A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
Colorado State Univ., Fort Collins. Dept. of Geology.
For primary bibliographic entry see Field 04D.
W71-00605

EROSION PROBLEMS AND CONTROL PRACTICES ON FEDERAL DOMAIN LANDS,
Bureau of Land Management, Logan, Utah.
For primary bibliographic entry see Field 04D.
W71-00607

FACTORS AFFECTING THE TRANSFER OF MATERIALS BETWEEN WATER AND SEDIMENTS,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 02K.
W71-00618

PROBLEMS IN THE CLIMATIC GEOMORPHOLOGY OF ARID LANDS,
New South Wales Univ., Kensington (Australia). School of Geography.
J. A. Mabbutt.
Annals of Arid Zone, Vol 8, No 2, p 209-224, September 1969. 34 ref.

Descriptors: *Weathering, *Geomorphology, *Arid lands, *Climatic zones, *Land forming, Semiarid climates, Sands, Rainfall, Vegetation, Geology, Aeolian soils, Wind erosion, Classification, Paleoclimatology, Deserts, Dunes.
Identifiers: *Wadis, *Morphogenetic classification, Endoreism, Insolation weathering.

Two major problems of desert studies are: (1) The nature of the developmental processes of arid zone landforms; (2) Definitive descriptions of arid and semiarid regions. Early investigators felt that deserts were static regions consisting of relict topographical forms. Gradually, the importance of wind and water, primarily as weathering agents, has come to be recognized. It is the author's view that the physicochemical effects of water are at least as important as the physical effects, and that wind and water are complex interacting agents whose effects decrease toward the arid core areas. A number of characteristic landform phenomena are described, but their usefulness as arid zone morphoclimatic indices has been limited. Additionally, vegetation, rainfall and the presence of sand dunes are examined in terms of the delimitations and subdivisions of arid regions, but none are truly definitive. This argument is buttressed by descriptions of a wide variety of warm arid climates, many of which differ greatly in crucial descriptive parameters. There are short discussions of past climatic changes as revealed by palaeoforms and the influences of anthropogenic factors. (Casey-Arizona)
W71-00700

LANDFORMS AND CLIMATIC CHANGE IN THE KALAHARI AND NGAMILAND,
Cambridge Univ. (England). Dept. of Geography.
A. T. Grove.
Geographical Journal, Vol 135, No 2, p 191-212, June 1969. 11 fig, 39 ref.

Descriptors: *Landforming, *Aerial photography, *Geomorphology, *Semiarid climates, *Climatic data, Dune succession, Erosion, Drainage density, Hydrogeology, Structural geology, Superimposed drainage, Terrain analysis, Topography, Weathering, Pleistocene epoch, Deserts, Sands, Paleoclimatology.
Identifiers: *Africa, *Kalahari Desert, *Sahelian zone, *Alab dunes, *Calcretes.

The Kalahari Desert is grass and tree-covered with a mean annual rainfall of 150-200 millimeters but with consistent year-round water deficits due to transpiration losses. A sequence of climatic changes have occurred since the Pleistocene through the present which have strongly influenced its morphology. These changes may be similar to but more striking than those of the Sahelian Zone which lies between the Saharan and Sudan Zones. The geomorphology of the area was studied by the use of aerial photographs in an effort to trace past climatic changes. The data suggest a number of tentative theories: (1) Alab dunes, running about parallel to present day winds represent a period when annual rainfall was probably much less than one-half present rainfall; (2) Massive underlying calcretes were probably deposited since the Pliocene during various semiarid climates similar to the present; (3) A more humid period followed in which extensive rivers probably flowed toward the Ngami and Mababe depressions, guided by alab dunes, creating extensive series of lakes; (4) A more arid period followed, probably creating dunefields and sand ridges. It is concluded that the unorganized drainage networks of the present Kalahari Desert and the Sahelian Zone are characteristic of areas where aridity has been replaced by more humid conditions. (Casey-Arizona)
W71-00702

SEDIMENT DISTRIBUTION AND HYDRODYNAMICS SACO RIVER AND SCARBORO ESTUARIES, MAINE,
Massachusetts Univ., Amherst. Coastal Research Group.
Stewart C. Farrell.
Available from the NTIS as AD 709 145, $3.00 in paper copy, $0.95 in microfiche. June 1970, 142 p. Contribution No. 6-CRG. NR388-084.
Identifiers: *Hydrology, Maine, *Rivers, Sedimentation, Distribution, Geologic age determination, Environment, Sand, Particle size, Saco River estuary, Scarboro estuary, *Estuarine hydrography, *Holocene sedimentation.

Using a combination of field observations and measurements and laboratory investigation of sampled materials, this study is an attempt to discover the processes responsible for the formation of the assemblage of Holocene sediment bodies present in the Saco Bay, Maine, area. By interpreting the processes and the significant features resulting from them in this and other areas currently under study by the University of Massachusetts Coastal Research Group, a clearer picture of the complex pattern of coastal sand-body development, it is anticipated, will emerge.
W71-00797

HYDROGRAPHY AND HOLOCENE SEDIMENTATION OF THE MERRIMACK RIVER ESTUARY, MASSACHUSETTS,
Massachusetts Univ., Amherst. Coastal Research Group.
For primary bibliographic entry see Field 02L.
W71-00798

STUDY OF EROSION IN ROADSIDE DRAINAGE CHANNELS IN NORTH CAROLINA,
North Carolina State Univ., Raleigh. School of Engineering.
For primary bibliographic entry see Field 04D.
W71-00806

HEAVY MINERAL INVESTIGATION OF CARMEL BAY BEACH SANDS,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 02L.
W71-00809

DYNAMIC PROPERTIES OF IMMERSED SAND AT VIRGINIA BEACH, VIRGINIA,
Virginia Inst. of Marine Science, Gloucester Point.
Wyman Harrison, and Morales-Alamo Reinaldo.
Available from NTIS as AD-459 520, $3.00 in paper copy, $0.95 in microfiche. December 1964. 52 p, Army Coastal Engineering Research Center. Technical memorandum No. 9.
Identifiers: *Beaches, Sand, *Sand, Sedimentation, Sampling, Particle size, Ocean waves, Wind, Viscosity, Temperature, Sea water, Drag, Reynolds number, Velocity, Mathematical analysis, Beach erosion, Virginia Beach.

On March 25, 1963, 219 sand samples were taken from the shoaling-wave, breaking-wave, swash-backwash, and foreshore zones of the beach. The following measurements were used to describe the properties of the samples: mean settling velocity in nature (as determined with a woods hole rapid sand analyzer and a special set of curves for settling velocity as a function of temperature), mean reynolds number (in nature), and mean drag coefficient (for an infinite fluid under natural conditions). Corey's (1949) shape factor and the dynamic shape factor of Briggs, Et Al (1962) were calculated and compared; the Corey shape factor was used in calculating mean settling velocity. Data for mean and median grain size (in nominal diameter) and sorting for each sample are presented.
W71-00811

BEACH PROFILE AS AFFECTED BY VERTICAL WALLS,
California Univ., Berkeley. Hydraulic Engineering Lab.
Abdel-Latif Kadib.
Available from NTIS as AD-420 424, $3.00 in paper copy, $0.95 in microfiche. June 1963. 49 p. Corps of Engineers, Beach Erosion Board Technical Memorandum 134.
Identifiers: *Beaches, Erosion, *Levees, Models (Simulations), Water, Control, Walls, Construction, Soil mechanics, Breakwaters, Beach erosion, Shore protection.

Results of a laboratory investigation of some aspects of the flow characteristics and wave attack at sand beaches protected by a vertical seawall are reported. The effects of the top elevation of the vertical wall, bed material characteristics, and different wave scale ratios were also investigated. Some conclusions are drawn regarding relative wall height and beach profile stability in front of and behind the wall.
W71-00833

SEDIMENT BALANCE OF CLYDE ESTUARY,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-00844

BLACK SEA: RECENT SEDIMENTARY HISTORY,
Woods Hole Oceanographic Inst., Woods Hole, Mass.
David A. Ross, Egon T. Degens, and Joseph MacIlvaine.
Science, Vol 170, No 3954, p 163-165, October 9, 1970. 3 p, 4 fig, 9 ref. NSF Grant GA-1659.

Descriptors: *Sediment distribution, *Recent epoch, *Environmental effects, *Sedimentation rates, Sedimentary basins (Geological), Fresh water, Sea water, Organic matter, Carbonates, Carbon radioisotopes, Cores.
Identifiers: *Black Sea, Sedimentary history.

To learn the origin and history of recent sediments, a detailed oceanographic survey of the Black Sea was made in 1969 during which 60 piston, gravity, and kasten cores were obtained and studied. This article describes some of the findings. Three distinct sedimentary units can be correlated throughout the basin. Carbon-14 ages help to define the recent sedimentary history. An upper unit 30 cm thick consists of microlaminated layers of light carbonate material with intervening darker layers containing more organic material. The second unit, about 40 cm thick, has an extremely high content of organic matter. The lowest unit consists of a sequence of alternating light and dark lutite; the organic content is higher in the dark layers and carbonate content is higher in the light layers. The sedimentary sequences reflect environmental changes that occurred during the time the Black Sea was a freshwater lake when cut off from the Mediterranean (20,00 to 10,000 yr ago) by the most recent worldwide lowering of sea level and later ice melting period, and after reconnection (7,000 to 12,000 yr ago) when salt water again entered the Black Sea and slowly increased salinity. Sedimentation rates are high in eastern parts of the basin bordering mountains but relatively low in western parts where sediments are trapped in river estuaries and on the broad shelf area. (Lang-USGS)
W71-00855

A PRELIMINARY INVESTIGATION OF SUSPENDED SEDIMENTS IN KAINJI LAKE, NIGERIA,
Ife Univ. (Nigeria).
Olayinka L. Asseez.
Bulletin International Association of Scientific Hydrology, Vol 15, No 3, p 61-70, September 1970. 10 p, 5 fig, 4 tab, 11 ref.

Descriptors: *Sedimentation, *Reservoirs, *Reservoir silting, Sediment yield, Suspended load, Sediment transport, Silting, Streamflow, Discharge (Water), Sediment discharge.
Identifiers: Kainji Lake (Nigeria), Niger River.

The suspended load of eight major western rivers flowing into Kainji Lake, Nigeria was determined as a part of the investigation of the suspended sediment of the reservoir. On whole the results of this study is in agreement with the previous conclusion that the sediment load of the Niger was low. A range of 29-221 ppm was observed within the reservoir whereas the concentration in the inflowing rivers varied from 122-953 ppm. It was however not possible to determine the total sediment load because discharge data were lacking. The overall rate of silting is slow but locally high rate of sediment supply gives cause for anxiety regarding the possible growth of deltas at the mouths of the river. (Knapp-USGS)
W71-00857

BED LOAD DISCHARGE OF THE RIVER TYNE, ENGLAND,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
T. C. Muir.
Bulletin International Association of Scientific Hydrology, Vol 15, No 3, p 35-39, September 1970. 5 p, 3 fig, 1 tab, 13 ref.

Descriptors: *Bed load, *Alluvial channels, *Sediment transport, Sampling, Surveys, Equations, Sediment discharge, Suspended load, Discharge (Water), Sediment load, Duration curves, Particle size, Stage-discharge relations.
Identifiers: Meyer-Peter and Muller formula, England, River Tyne.

Bed load movement was studied at the Bywell cableway gaging station on the River Tyne in Northern England. Bed load rating curves are derived using several bed load discharge formulae. Average annual bed load discharges are computed from long-term flow records. The results of the Meyer-Peter and Muller equation, showing an average annual bed load discharge of 14,900 tons (approximately 11% of the average annual suspended sediment load), are considered to be the most reliable. (Knapp-USGS)
W71-00859

FACTORS CONTROLLING THE GEOMETRY OF FLUVIAL MEANDERS,
East Pakistan Univ., of Engineering and Technology, Dacca. Dept. of Civil Engineering.
M. Shahjahan.
Bulletin International Association of Scientific Hydrology, Vol 15, No 3, p 13-24, September 1970. 12 p, 9 fig, 1 tab, 15 ref.

Descriptors: *Meanders, *Channel morphology, *Sediment transport, Alluvial channels, Sedimentation, Discharge (Water), Streamflow, Velocity, Sediment load, Bed load, Slopes, Sediment discharge.
Identifiers: Meander geometry.

The geometry of a meandering stream depends strongly on the relative stream size, on the valley slope, Sv, and on the charge, Qs/Q, where Q and Qs are the fluid and sediment discharges respectively, and D is the mean sediment size. The geometry depends less strongly on the relative settling size of sediment. For constant values of Q, Sv and D, the effect of increase of charge reduces the meander length, ML, and the mean channel surface width, B, whereas meander width, MB, bend radius, RM, and mean channel depth, H, increase. For a constant value of relative stream size the values of ML, MB, RM, and B increase with the increase of valley slope but the value of H tends to decrease. (Knapp-USGS)
W71-00862

THE INFLUENCE OF DEPOSIT-FEEDING ORGANISMS ON SEDIMENT STABILITY AND COMMUNITY TROPHIC STRUCTURE,
Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics; and Marine Biological Lab., Woods Hole, Mass.
For primary bibliographic entry see Field 02L.
W71-00869

ORGANIZING FOR SOIL EROSION AND SEDIMENT CONTROL IN OUR NATIONS URBAN AREAS,
National Association of Counties Research Foundation, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-00877

RIVERS OF DUST.
For primary bibliographic entry see Field 02B.
W71-00886

HOLOCENE SEDIMENTS OF THE PARKER RIVER ESTUARY, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology.
For primary bibliographic entry see Field 02L.
W71-00900

CHARACTERIZATION OF BOTTOM SEDIMENTS: CATION EXCHANGE CAPACITY AND EXCHANGEABLE CATION STATUS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Soils and Crops.
For primary bibliographic entry see Field 02K.
W71-01059

MEANDER GEOMETRY ARISING FROM VARYING FLOWS,
Hydraulics Research Station, Wallingford (England).
Peter Ackers, and F. G. Charlton.
Journal of Hydrology, Vol 11, No 3, p 230-252, September 1970. 23 p, 6 fig, 1 tab, 24 ref.

Descriptors: *Channel morphology, *Meanders, *Alluvial channels, *Hydraulic models, Sands, Discharge (Water), Sediment transport, Sedimentation, Bed load, Streamflow, Stage-discharge relations, Geomorphology, Channel erosion, Scour, Regime, Model studies, Steady flow, Unsteady flow.
Identifiers: Meander geometry.

Experimental research on meandering channels, carried out in a large bed of sand at Wallingford, included tests with cyclic varying discharges. Comparisons of meander length with experiments under steady conditions provide information on the 'formative' or 'dominant' discharge. Field data used for comparison include mean discharge, average flow in the month of maximum flow, mean annual flood, and bank-full discharge. This tends to confirm bank-full flow as the condition which generates the characteristic meander length. (Knapp-USGS)
W71-01061

EFFECTS OF ORGANIC ACIDS ON THE FLOCCULATION OF SUSPENDED SEDIMENTS IN TROPICAL MAN-MADE LAKES,
Ife Univ. (Nigeria).
For primary bibliographic entry see Field 02H.
W71-01062

COMPUTATION OF STABLE CANAL BEDS IN WEAK, FINE-GRAINED GROUND,
N. V. Lapturev.
Translation from Gidrotekhnika i melioratsiya, No 10, p 26-33, 1969. Soviet Hydrology: Selected Papers, Issue No 3, p 320-327, 1969. 8 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Streambeds, *Channel flow, *Hydraulics, *Sedimentation, *Mathematical studies, Equations, Deposition (Sediments), Particle size, Sedimentary structures, Sediment distribution, Erosion, Foreign projects, Alluvial channels, Scour, Stream erosion.
Identifiers: Stable streambed, Fine-grained bottom, USSR.

Methods for computing parameters in determining particle size of stream (or canal) beds are presented. The main and determining factor in the formation of a river channel is water discharge with which all the other hydraulic elements are closely associated. In the particular case of canals of irrigation systems on lowland rivers investigated from a laboratory analysis of field observations, equations were formulated from relationships for stream depth, flow velocity, channel width, wetted perimeter, hydraulic radius, channel slope, maximum stream depth, the Chezy coefficients, and the fall velocity of the particles in the stream. Computations agree reasonably well with the results of field observations (which are included in the report). The methods recommended by existing standards for computing the beds of canals have significant shortcomings. In some cases, as when canals cross noncohesive fine-grained ground, these shortcomings can lead to inaccurate solutions, excessive construction work, and great costs in maintaining the canal beds in good repair during operation. The relationships obtained here for computing erosion- and silt-stable canal beds will not only simplify the method of hydraulic computations, but improve its accuracy. (Woodard-USGS)
W71-01094

2K. Chemical Processes

SOLUBILITY AND HYDROLYSIS OF ALUMINUM IN SOIL SOLUTIONS AND SATURATED-PASTE EXTRACTS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
John S. Richburg, and Fred Adams.
Soil Science Society of America Proceedings, Vol 34, No 5, p 728-734, September-October 1970. 7 p, 2 fig, 7 tab, 32 ref.

Descriptors: *Hydrolysis, *Aluminum, *Soil chemistry, Solubility, Chemical reactions, Computer programs, Hydrates, Molecular structure, Soil analysis, Soil structure.
Identifiers: Aluminum ion activities (Soils), Cations, Soil chemical activity.

Three Coastal Plains soils with different 'critical' pH values for maximum cotton yields in field experiments were analyzed for Al solubility. Fertilized soil was used to verify critical pH by a root-growth experiment in a growth-chamber, as well as to obtain displaced soil solutions and water extracts from saturated pastes. Extracts were also obtained from saturated pastes made with 0.01M and 0.05M KCl and with 0.0033M and 0.0167M CaCl2. Solutions were analyzed for pH, Ca, Mg, Mn, K, NH4, Al, and SO4; the remaining ions required for electrical neutrality were assumed to be Cl and NO3. A computer program was used to solve for ion activities and ion-pair concentrations, including various Al-ion species. Calculated values were much lower for polymeric hydrolysis than for monomeric hydrolysis. (Knapp-USGS)
W71-00553

OXYGEN AND HYDROGEN ISOTOPE RATIOS OF MONTHLY COLLECTED WATERS FROM NASUDAKE VOLCANIC AREA, JAPAN,
Tokyo Univ. of Education (Japan). Dept. of Chemistry; and Tokyo Univ. (Japan). Ocean Research Inst.
Minoru Kusakabe, Hiroaki Wada, Sadao Matsuo, and Yoshio Horibe.
Journal of Geophysical Research, Vol 75, No 30, p 5941-5951, October 20, 1970. 11 p, 9 fig, 2 tab, 24 ref.

Descriptors: *Stable isotopes, *Deuterium, *Thermal water, *Volcanoes, Magmatic water, Hot springs, Water chemistry, Water sources, Steam, Radioisotopes, Surface waters, Rainfall, Precipitation (Atomospheric), Tracers, Geochemistry, Groundwater movement.
Identifiers: *Oxygen isotopes, *Fumaroles.

Monthly variation of oxygen isotopes of two fumarolic condensates, five hot spring waters, two stream waters, and meteoric precipitation at the Nasudake volcanic area of Japan was measured. There was no remarkable variation with time in the isotopic ratios of the samples except for meteoric precipitation and for one of the hot spring waters. The delta D and delta O-18 of meteoric precipitation showed seasonal change with summer maximum and winter minimum. The D and O-18 of the stream waters and two of the hot spring waters were identical with those of average precipitation. The residence time of precipitation water under the ground was calculated to be not shorter than a few years. Precipitation did not directly affect the isotopic ratios of volcanic waters. Deuterium content of thermal waters was found to be higher than that of surface waters by 7 parts per thousand on the average. This slight enrichment of deuterium was inferred to be due to subsurface clay formation. (Knapp-USGS)
W71-00559

AN AIRBORNE MEASUREMENT OF THE SALINITY VARIATIONS OF THE MISSISSIPPI RIVER OUTFLOW,
Lockheed Electronics Co., Houston, Tex., and National Aeronautics and Space Administration, Houston, Tex.
J. D. Droppleman, R. A. Mennella, and D. E. Evans.
Journal of Geophysical Research, Vol 75, No 30, p 5909-5913, October 20, 1970. 5 p, 5 fig, 1 tab, 2 ref.

Descriptors: *Salinity, *Mississippi River, *Remote sensing, *Microwaves, *Electromagnetic waves, Radio waves, Radiation, Aircraft, Instrumentation, Radar, Measurement.
Identifiers: Passive microwave measurements, Radiometry.

Passive microwave radiometric measurement of salinity variations were made at the south and southwest passes of the Mississippi River on September 27, 1969. The passive microwave system can measure radiometric energy in four bands centered on 1.4, 10.6, 22.2, and 31.4 GHz. No radiometric temperature change (within instrumental limits) was observed with the 10.6-, 22.2-, or the 31.4-GHz radiometers. A radiometric change of 13--18 deg K was observed with the 1.4-GHz radiometer. This observed change and the absence of an observed change by the other channels agrees (within experimental limits) with the theoretically predicted radiometric temperature variation for water at 25 deg C. This measurement demonstrates that an airborne passive microwave radiometer operating at 1-1.5 GHz can rapidly measure salinity and variations in salinity over large areas. (Knapp-USGS)
W71-00562

REMOTE ANALYSIS OF FLUORESCENCE BY A FRAUNHOFER LINE DISCRIMINATOR,
Geological Survey, Washington, D. C.; and Perkin-Elmer Corp., Norwalk, Conn.
George E. Stoertz, William R. Hemphill, and David A. Markle.
Reprint of Paper presented at Marine Technology, 1970, Marine Technology Society 6th Annual Conference, Wash, DC, June 29-July 1, 1970. Vol 2, 22 p, 13 fig, 1 tab, 30 ref.

Descriptors: *Remote sensing, *Fluorometry, *Dye releases, *Tracking techniques, Optical properties, Fluorescence, Instrumentation, Photometry, Path of pollutants, Dispersion, Water pollution sources.
Identifiers: Rhodamine WT.

A prototype Fraunhofer line discriminator (FLD), an optical instrument for remote detection of substances that fluoresce when irradiated by sunlight, operates at the sodium D2 line (5890 A), automatically measuring solar-stimulated fluorescence against a background of reflected sunlight. Over water it functions as an airborne or shipboard fluorometer, measuring substances that fluoresce amber, such as rhodamine dyes. The FLD detected Rhodamine WT in a tank of water 1/2-meter deep in concentrations as small as 1 ppb. Shipboard and helicopter tests show that the dye normally can be monitored in concentrations less than 5 ppb, whether in clear river water, moderately turbid marine coastal water, or highly turbid estuaries. Tests to altitudes of 5,000 feet show little loss of sensitivity. Applications of the FLD include sensing fluorescent dye in studies of current dynamics and dispersion. Use of other lines may permit monitoring of oil spills, detergents, algal blooms, distribution of phytoplankton, and fluorescent chemicals such as lignin sulfonates, associated with pulp- and paper-mill wastes. (Knapp-USGS)
W71-00565

AN APPROACH TO RESERVOIR TEMPERATURE ANALYSIS,
Army Corps of Engineers, Sacramento, Calif., Hydrologic Engineering Center.
For primary bibliographic entry see Field 02H.
W71-00567

VERTICAL TEMPERATURE STRUCTURE AND WATER SURFACE HEAT EXCHANGE,
Pennsylvania Univ., Pa.
For primary bibliographic entry see Field 02H.
W71-00568

SALINE GROUNDWATER RESOURCES OF THE CONTERMINOUS UNITED STATES,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 03C.
W71-00574

PLAYA WATER QUALITY CHANGES WITH TIME AND EFFECTS ON CLARIFICATION,
Agricultural Research Service, Bushland, Tex. Soil and Water Conservation Research Div.
Oliver R. Lehman, and Victor L. Hauser.
Water Resources Research, Vol 6, No 5, p 1420-1423, October 1970. 4 p, 2 tab, 5 ref.

Descriptors: *Playas, *Water quality, *Water resources development, *Artificial recharge, Water conservation, Turbidity, Nutrients, Irrigation water, Water sources, Water analysis, Water treatment.
Identifiers: Water clarification.

An estimated 2 to 5 million acre-feet of runoff water accumulates annually in playas on the semiarid southern high plains; however, development of this large potential water source has been impeded by lack of water quality data. Most of the water is lost by evaporation, and timely utilization is essential. Therefore, a particular need exists for quality data on freshly impounded water. Water from five playas was sampled and analyzed at intervals for 24 days following runoff from a single storm. Chemical analyses showed playa waters were excellent for irrigation; however, adequate economical clarification is probably needed for such projects as direct aquifer injection. With aging, less synthetic cationic polyelectrolyte and more alum was required for water clarification. Initially low nitrate and chemical oxygen demand values decreased with time. (Knapp-USGS)
W71-00578

SILICA IN THE GROUNDWATERS OF PETROLEUM RESERVOIRS IN THE PRE-CARPATHIAN DOWNWARP,
Akademiya Nauk URSR, Lvov. Inst. of Geology and Geochemistry of Fossil Fuels.
V. M. Shchepak, and V. I. Migovich.
Translated from Geokhimiya, No 11, p 1397-1404, 1969. Geochemistry International, Vol 6, No 6, p 1093-1100, 1969. 8 p, 7 tab, 7 ref.

Descriptors: *Water chemistry, *Silica, *Oil fields, *Geochemistry, *Exploration, Surveys, Oil industry, Subsurface investigations, Chemical reactions, Aquifers.
Identifiers: *Geochemical prospecting, *USSR, Carpathian downwarp.

Silica content was investigated in highly mineralized connate waters related and unrelated to the petroleum deposits of the Pre-Carpathian downwarp. It was found that petroleum accumulations are surrounded by waters with relatively low silica content; values are nearly all less than 4 mg/liter. This fact may be used as an additional hydrochemical indicator in the search for gas and petroleum-bearing structures in Pre-Carpathia and other petroliferous regions. (Knapp-USGS)
W71-00612

A POLAROGRAPHIC TECHNIQUE FOR THE MEASUREMENT OF DISSOLVED SULPHIDE IN WATERLOGGED SOILS,
University Coll. of South Wales and Monmouthshire, Cardiff. Dept. of Botany.
W. Armstrong.
Journal of Soil Science, Vol 18, No 2, p 282-288, September 1967. 7 p, 3 fig, 10 ref.

Descriptors: *Polarographic analysis, *Sulfides, *Saturated soils, Electrodes, Temperature.
Identifiers: Dropping mercury electrode, Saturated calomel electrode, Agar-KCl bridge.

Soil solution is expressed from cores removed from the soil in a Hiller-type borer, and transferred to tubes containing pyrogallol and NaOH. A current-voltage curve for each sample is then obtained using the dropping mercury electrode in conjunction with a saturated calomel electrode. The current in the plateau region of a curve is proportional to the sulfide concentration, and after volume and temperature corrections the sulfide concentration

in a sample can be read from a previously prepared calibration curve. The possibility of sulfide loss from the samples before analysis has been found to be slight. Details of construction, and calibration of the dropping mercury electrode using standard Na2S solutions, are included in the description of the technique and apparatus. The inclusion of such minor modifications as (a) the insertion of a condenser across the microammeter terminals to dampen the large current oscillations produced by the dropping mercury electrode, and (b) the inclusion of a switch to allow reversal of polarity at the microammeter, enabled a circuit of the type currently used for soil oxygen diffusion measurements to be used also for sulfide estimation. (Woodard-USGS)
W71-00616

FACTORS AFFECTING THE TRANSFER OF MATERIALS BETWEEN WATER AND SEDIMENTS,
Wisconsin Univ., Madison. Water Resources Center.
G. Fred Lee.
Available from NTIS as PB-195 220, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Univ, Madison, Water Resources Center, Eutrophication Information Program, Literature Review No 1, 1970. 50 p, 120 ref. OWRR Project W-117 (1614) (1).

Descriptors: *Sediments, *Sedimentology, Sediment-water interfaces, Particle size, Lake soils, Lakes, Phosphorus, Chemical properties, Eutrophication, Nitrogen, Hydrodynamics, Oxidation-reduction potential, Sorption.
Identifiers: *Phosphate buffer, *Phosphate levels, Biological factors, Acid-base, Precipitation-solubilization, Complexation, Exchange reactions.

A general description of the possible factors involved in various kinds of exchange reactions between waters and sediments is presented. Basically, the exchange reactions have been broken down into physical control, where hydrodynamics plays the important role in determining the rate of exchange, and biological and chemical control where the processes bringing the material onto or from the surface of the solid are the major function. Knowledge of exchange reactions and the factors influencing them appears to be extremely meager. In fact, it is almost impossible to make any predictions about the magnitude or rate of exchange for any species in a system that has not been investigated. Hopefully, current research in this area will help to eliminate this deficiency in knowledge within a few years. (Lee-Wisconsin)
W71-00618

ANALYSIS OF TIME-VARIANT BEHAVIOR OF WATER CHEMISTRY,
Nevada Univ., Reno. Desert Research Inst.
John V. A. Sharp.
Available from NTIS as PB-195 305, $3.00 in paper copy, $0.95 in microfiche. Preprint No 71, Paper H-23, presented at 51st Annual Meeting of American Geophysical Union, Washington, DC, April 21, 1970. 10 p, 4 fig, 3 ref. OWRR Projects A-017-NEV (3) and A-024-NEV (3).

Descriptors: *Water quality, *Time series analysis, *Sampling, *Water chemistry, Frequency analysis, Statistical methods, Stochastic processes, Streamflow, Water pollution sources, Seasonal, Data collections.
Identifiers: Water quality variation.

Time-variant behavior of water chemistry is controlled by internal factors of a hydrologic system and by external stimuli. Periodic sampling of water provides data to compute this variation. The observed time variation can be modeled as a discontinuous time series, composed of time-systematic and stochastic components. The stochastic component is a residual attributed to random fluctuations in the parent water chemistry and in sampling analysis. Nonparametric tests confirm and amplify results of serial correlation. Tests are selected for their discrimination against specific time-variant alternatives to constant behavior. Several examples demonstrate the interplay between serial correlation and nonparametric techniques and some of the interpretative difficulties met in practice. (See also W71-00630). (Knapp-USGS)
W71-00629

TIME-DEPENDENT BEHAVIOR OF WATER CHEMISTRY IN HYDROLOGIC SYSTEMS,
Nevada Univ., Reno. Desert Research Inst.
John V. A. Sharp.
Available from NTIS as PB-195 306, $3.00 in paper copy, $0.95 in microfiche. Preprint No 68, Desert Research Institute, Nevada University, May 1969. 11 p, 9 fig. OWRR Project No A-017-NEV (2), and A-024-NEV (2).

Descriptors: *Water quality, *Variability, Sampling, Fluctuation, Statistics, Data collections, Hydrologic data, Water chemistry, Water pollution sources, Path of pollutants.
Identifiers: Water quality variation.

Water chemistry at a pount in a hydrologic system varies continuously with time. In order to characterize this series it is necessary to monitor the water chemistry, either on a discontinuous basis, for example, discrete monthly sampling, or on a continuous basis. A general model of the resulting time-dependent behavior is the sum of two components. One component is described deterministically by a mathematical function of time which is the basis for the behavioral classification. The second component is unsystematic, fluctuating randomly. This 'noise' is an unresolved mixture of random variation in both chemistry of the water and sampling/analysis procedures. In practice, the unsystematic omponent is the residual from the systematic and describes some probability distribution. The unsystematic component is regarded as superimposed on the systematic component and to a varying degree obscures it. Combinations occur of trend, cyclical, and oscillatory behavior. Some examples of time-dependent behavior as exhibited by water points in Nevada and eastern California are discussed. (See also W71-00629). (Knapp-USGS)
W71-00630

ADSORPTION OF ORGANIC COMPOUNDS ONTO SOLIDS FROM AQUEOUS SOLUTIONS,
Virginia Polytechnic Inst., Blacksburg.
For primary bibliographic entry see Field 01B.
W71-00633

OXYGEN PRODUCTION IN EXPERIMENTAL CHANNELS,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
P. G. Meier, J. J. Gannon, and M. E. Bender.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 17 p, 15 fig, 4 tab, 20 ref.

Descriptors: *Oxygen, *Streams, *Algae, Velocity, Light, Biomass, Respiration, Photosynthesis, Dissolved oxygen, Reservoirs, Aeration, Plant growth, Chlorophyll, Phytoplankton, Periphyton, Model studies, Hydrologic models, Simulation.
Identifiers: Oxygen deficit, Oxygen production.

Two levels of each variable--velocity, light, biomass, and oxygen deficit--were incorporated into a factorial design to determine their effects on algal (attached and free-floating) oxygen production and respiration in flowing systems. The dissolved oxygen concentration was depressed in river water, stored in reservoirs and passed through channels. Increase in dissolved oxygen concentration was used to calculate photosynthetic contribution above physical reaeration. Data indicated that effects of light and growth and their interactions were highly significant while no significant effects of high and low oxygen deficit and high and low current velocity were observed. Flow was the only variable in later experiments and its influence on biomass, chlorophyll concentration, respiration, and oxygen production was investigated. Results indicated that their amounts were as great if no greater in the low as in the higher velocities, although more time was required for biological equilibrium. Effect of light on oxygen production was under observation. In velocities .25 through 1.4 fps, oxygen production and biomass accrual of attached algae vary insignificantly. A total oxygen asset of approximately 2 milligrams dissolved oxygen of milligram of chlorophyll a per day was calculated. (Jones-Wisconsin)
W71-00660

PHOTOSYNTHESIS AND ZONATION OF FRESHWATER MACROPHYTES. I. DEPTH DISTRIBUTION AND SHADE TOLERANCE,
Saint Andrews Univ. (Scotland). Dept. of Botany.
D. H. N. Spence, and Jean Chrystal.
New Phytologist, Vol 69, No 1, p 205-215, 1970. 5 fig, 5 tab, 17 ref.

Descriptors: *Photosynthesis, *Fresh water, Depth, Lakes, Oxygen, Productivity, Light intensity, Chlorophyll, Swamps, Ecosystems, Laboratory tests.
Identifiers: *Macrophytes, Potamogeton praelongus, Potamogeton obtusifolius, Zonation, Potamogeton natans, Potamogeton polygonifolius, Potamogeton z Zizii, Myriophyllum spicatum, Myriophyllum gramineus.

The effects of varying light intensity upon rates of photosynthesis by certain species of submerged higher plants are described. The mean, range, and standard deviation are given of the depths of water above the soil surface in which a number of Potamogeton species occur in Scottish lochs. Sun leaves of these species were produced in unscreened containers in a glasshouse and their rates of net oxygen production were measured at irradiances of from 1.34 to 7.08 calories/square centimeter per hour in a Warburg apparatus, using Warburg buffer No 11 as bathing solution. Using only leaves of species of which the rates appeared to be unaffected by buffer solution during the experiments, it was shown that the shade tolerance of these leaves is correlated with the natural depth distribution of the species. This valid contrast in inherent photosynthesis response between some deep water species (for example, P praeongus, P obtusifolius) and some shallow water species (P polygonifolius) indicates that light may be as important as substrate or competition in controlling the zonation of freshwater macrophytes. (Jones-Wisconsin)
W71-00670

CHANGE OF C/N RATIO DURING THE COURSE OF DEVELOPMENT OF SPHAEROMA SERRATUM (CRUSTACEAN ISOPODE) (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
Pierre Kerambrun.
Comptes Rendus Academie des Sciences, Paris, Vol 270, No 4, Serie D, p 635-637, 1970. 2 fig, 3 ref.

Descriptors: *Isopods, *Crustaceans, Carbon, Nitrogen, Marine animals, Benthic fauna.
Identifiers: *Carbon:nitrogen ratio, Sphaeroma serratum, Sexual activity, T-test, Gulf of Marseille.

Determination of carbon, hydrogen, and nitrogen in tissues of Sphaeroma serratum in different stages of development revealed that carbon/nitrogen ratio fluctuates with the weight of organisms. The carbon/nitrogen ratio of young isopodes is about 6.3; it increases to the maximum of 6.8 when the organisms attain a dry weight of approximately 15 milligrams. Further growth induces a decrease of the carbon/nitrogen ratio which in specimens exceeding 30 milligrams drops to the original value of 6.3. This decrease, coinciding with the period of max-

mum sexual activity, is largely due to the augnented content of nitrogen. (Wilde-Wisconsin)
W71-00680

EXPERIMENTAL STUDIES OF THE TURNOVER OF PHOSPHATE IN MARINE ENVIRONMENTS,
Georgia Univ., Athens. Dept. of Zoology; and Georgia Univ., Sapelo Island. Marine Inst.
Lawrence R. Pomeroy.
Radioecology, Proceedings of the 1st National Symposium on Radioecology, Colorado State University, Fort Collins, September 10-15, 1961. New York, Reinhold, 1963. p 163-166, 5 fig, 1 tab, 2 ref.

Descriptors: *Phosphates, *Sea water, *Turnovers, Phosphorus radioisotopes, Tracers, Photosynthesis, Estuarine environment, Bacteria, Cycles, Seasonal, Radioactivity, Plankton, Detritus, Suspended load, Georgia, Light, Salt marshes, Brackish water.
Identifiers: *Short-term phosphate turnover, Antibiotics, Methylene blue, Gulf Stream, Inorganic solids, Phosphorylation, Doboy Sound (Ga), Sapelo Island (Ga), Kryptoperidinium, Nostocaceae, Altamaha River (Ga).

An understanding of the phosphorus cycle requires a critical examination of the short-term events upon which seasonal cycles are balanced. Short-term events may be physical or biological; they may be sorption reactions or may involve active uptake and release of phosphate by living organisms. An attempt is made to separate experimentally the physical from the biological processes, to evaluate their relative importance in the short-term turnover of phosphate in natural waters, and to make some preliminary attempts to identify the processes involved. The addition of methylene blue and cyanide to natural waters blocks the short-term turnover of phosphate between water and suspended solids; the turnover is therefore believed to involve biological processes, probably phosphorylation. In darkness the turnover rate of phosphate is sometimes reduced, suggesting that photosynthetic organisms can play a significant role in phosphate turnover, perhaps in proportion to their abundance. Addition of antibiotics to sea water and estuarine water may inhibit the release of phosphates from suspended solids, but often has little effect. Therefore, the role of bacteria in phosphate turnover may vary greatly and may depend on the size or character of the bacterial flora. (Jones-Wisconsin)
W71-00683

PROBLEMS IN THE CLIMATIC GEOMORPHOLOGY OF ARID LANDS,
New South Wales Univ., Kensington (Australia). School of Geography.
For primary bibliographic entry see Field 02J.
W71-00700

ION-ION AND ION-MOLECULE INTERACTIONS IN AQUEOUS SALT SOLUTIONS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 01B.
W71-00705

PREDATOR-PREY RELATIONSHIP. SEA STARS-BIVALVES. THE CHEMICAL BASIS OF THE RESPONSE OF ASTERIAS VULGARIS TO CRASSOSTREA VIRGINICA. A BIOASSAY, ITS APPLICATIONS AND THE PARTIAL PURIFICATION OF AN ACTIVE EXTRACT,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-00787

OCEANOGRAPHY: A BIBLIOGRAPHY OF SELECTED ACTIVATION ANALYSIS LITERATURE.
National Bureau of Standards, Washington, D.C., Analytical Chemistry Div.
For primary bibliographic entry see Field 10.
W71-00795

POLLUTION ANALYSIS: A BIBLIOGRAPHY OF THE LITERATURE OF ACTIVATION ANALYSIS.
National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.
For primary bibliographic entry see Field 10.
W71-00796

CONCENTRATIONS OF PARTICULATE IRON IN ATLANTIC OPEN-OCEAN WATER,
Rhode Island Univ., Kingston. Narragansett Marine Lab.
Peter R. Betzer, and Michael E. Q. Pilson.
Journal of Marine Research, Vol 28, No 2, p 251-267, May 15, 1970. 17 p, 2 fig, 4 tab, 18 ref, append. ONR Contract No 396 (08).

Descriptors: *Suspended load, *Iron, *Sea water, *Atlantic Ocean, Spectrophotometry, Sampling, Depth, Methodology, Geochemistry, Biochemistry, Diatoms, Phytoplankton, Reviews.
Identifiers: *Particulate iron concentrations, Caribbean Sea, Atomic absorption spectroscopy.

Measurements of particulate iron concentrations by atomic absorption spectroscopy have been carried out on samples from the western Atlantic Ocean and the Caribbean Sea. The average of 184 iron determinations on shallow open-ocean water (o-300 m) was 0.177 micrograms per liter; the average of 112 determinations on deep water (500-7535 m) was 0.255 micrograms per liter. These averages are lower than previous estimates by an order of magnitude or more. Spectrophotometric and atomic-absorption analyses carried out on a set of duplicate samples from the surface water of the Puerto Rican Trench indicate that the method of analysis is not the reason for the large discrepancy observed in the concentrations of particulate iron. Included in the report are related tables of data, and a map of sample collection sites. (Woodard-USGS)
W71-00867

STUDY AND INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF NATURAL WATER,
Geological Survey, Washington, D.C.
John D. Hem.
For sale by the Superintendent of Documents, U S Government Printing Office, Wash, D C, 20402 - Price $2.25 per copy. Geological Survey Water-Supply Paper 1473, 1970 (Second Edition). 363 p, 51 fig, 2 plate, 29 tab, 416 ref.

Descriptors: *Water quality, *Water chemistry, *Water analysis, *Sampling, Water structure, Radioactivity, Solutes, Aqueous solutions, Chemical reactions, Thermodynamics, Water pollution sources, Pollutant identification, Biochemistry, Weathering, Leaching, Laboratory tests, Analytical techniques, Hydrologic cycle, Chemistry of precipitation, Geochemistry.
Identifiers: Chemistry of natural water (Textbook).

This textbook has two principal objectives: (1) to outline the principles and processes, chemical and environmental, which shape and control the chemical composition of natural water, and (2) to discuss the chemistry of individual constituents and methods of data interpretation, and to present associated bibliographic references. The chemical composition of rocks, the ocean, and the atmosphere are significant in evaluating sources of solutes in natural fresh water. Fundamental data used in the determination of water quality are obtained by the chemical analysis of water samples in the laboratory or onsite sensing of chemical properties in the field. More than 60 constituents and properties are frequently included in water analysis. Graphing of analyses or of groups of analyses aids in showing chemical relationships among waters, probable sources of solutes, areal water-quality regimen, and water-resources evaluation. About 75 water analyses selected from the literature are tabulated to illustrate the relationships described. Relationships of water composition to source rock type are illustrated by graphs of some of the tabulated analyses. Water-quality standards for domestic, agricultural, and industrial use have been published by various agencies. Irrigation project requirements for water quality are particularly intricate. (Knapp-USGS)
W71-00879

THE pH OF WATER IN FLORIDA STREAMS AND CANALS,
Geological Survey, Tallahassee, Fla.
Matthew I. Kaufman.
Florida Bureau of Geology Map Series 37, 1970. 1 sheet, 6 fig, 1 map, 2 tab, 10 ref.

Descriptors: *Hydrogen ion concentration, *Surface waters, *Florida, Maps, Acidity, Streams, Canals, Discharge (Water), Streamflow, Bicarbonates, Color, Conductivity.
Identifiers: Relationship curves, Chemical characteristics.

This report presents in a succinct and usable form information on the pH of streams and canals throughout Florida as an aid to water managers, users, and planners. The variations in pH are related to environmental causes. The minimum pH of water and the range through which the pH of stream waters fluctuate in the various geographic areas is significant with respect to industrial, municipal, and recreational uses, aquatic productivity, the State of Florida's water quality such as culverts, in addition to governing the toxicity, mobility, and solubility of many compounds. (Woodard-USGS)
W71-00883

RELATION OF SOIL HYDRAULIC CONDUCTIVITY TO EXCHANGEABLE CATIONS AND SALINITY,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-00895

CONTINUOUS CATALYTIC DECOMPOSITION OF METHANE,
Battelle Memorial Institute, Columbus, Ohio.
For primary bibliographic entry see Field 05D.
W71-00909

CHARACTERIZATION OF BOTTOM SEDIMENTS: CATION EXCHANGE CAPACITY AND EXCHANGEABLE CATION STATUS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Soils and Crops.
Stephen J. Toth, and Arthur N. Ott.
Environmental Science and Technology, Vol 4, No 11, p 935-939, November 1970. 5 p, 4 tab, 11 ref.

Descriptors: *Bottom sediments, *Ion exchange, *Cation exchange, *Clays, Iron, Manganese, Organic soils, Organic matter, Oxidation-reduction potential, Soil chemistry, Sampling, Rivers, Estuaries, Lakes, Reservoirs, Water chemistry.
Identifiers: Cation exchange capacity.

Two parameters, cation exchange capacity (CEC) and exchangeable cation status (ECS), were used to characterize bottom sediments collected from rivers, bays, and freshwater impoundments. It was necessary to investigate the effect of drying on CEC and exchangeable Fe and Mn to arrive at satisfactory modifications of soil techniques used for these parameters. Wide variations were obtained in CEC and ECS values for the sediments. CEC and ECS values may be utilized for determining saltwater intrusions and pollution effects. (Knapp-USGS)
W71-01059

TRITIUM IN SURFACE WATER HYDROLOGY-EXPERIMENTAL DETERMINATION OF THE RUNOFF COEFFICIENT (FRENCH),
Bureau of Geological and Mining Research, Orleans (France).
For primary bibliographic entry see Field 02A.
W71-01060

2L. Estuaries

BIOLOGICAL ZONATION RELATED TO GROUNDWATER DISCHARGE ALONG THE SHORE OF BISCAYNE BAY, MIAMI, FLORIDA,
Geological Survey, Miami, Fla. Water Resources Div.
F. A. Kohout, and M. C. Kolipinski.
In: Estuaries, Publication No 83, American Association for the Advancement of Science, Wash, DC, p 488-499, 1967. 12 p, 16 fig, 1 tab, 27 ref.

Descriptors: *Discharge (Water), *Springs, *Salinity, *Ecological distribution, *Saline water-freshwater interfaces, *Florida, Barriers, Biological communities, Distribution, Spatial distribution, Groundwater movement, Water levels, Saline water intrusion.
Identifiers: Biscayne Bay (Fla).

Discharge of fresh groundwater through the littoral bottom sediments of a bay or shallow sea may produce a biological zonation. The overriding function appears to be that of dilution of the interstitial water and nearshore sea water. Zonation should exist along any shoreline where a fresh groundwater reservoir is hydraulically connected to a saltwater body through permeable bottom sediments. The hydrological factors leading to zonation are demonstrated by the resulting gradation of flora and fauna at a site near Miami, Florida. The coral, Siderastrea sideria, dropped out landward at about 700 feet from shore, where the salinity ranged from 21 to 30 ppt, and the loggerhead sponge, Sphecospongia vesparia, dropped out at 400 feet from shore where the salinity ranged from 13 to 28 ppt. The gastropods, Turbo castaneus and Columbella rusticoides dropped out in the shoreward region of freshened bay water. In contrast, the brackish forms, such as Neritina virginea and Taphromysis bowmani, decrease seaward. These distributions focus at a distance of about 300 feet from shore, which is also the distance at which the main part of the groundwater discharge terminates. (Knapp-USGS)
W71-00615

NUTRIENT AND PLANKTON ECOLOGY OF THE COLUMBIA RIVER ESTUARY,
Oregon State Univ., Corvallis. Dept. of Oceanography.
Lois Haertel, Charles Osterberg, Herbert Curl, Jr, and P. Kilho Park.
Ecology, Vol 50, No 6, p 962-978, 1969. 8 fig, 8 tab, 38 ref.

Descriptors: *Nutrients, *Plankton, *Ecology, *Estuaries, *Columbia River, Brackish water, Saline water, Nitrates, Phosphates, River flow, Silicates, Solar radiation, Temperature, Hydrography, Scenedesmus, Euglenophyta, Pyrrophyta, Light intensity, Rotifers, Copepods, Daphnia, Aquatic microorganisms, Oxygen, Regression analysis, Zooplankton, Phytoplankton.

Monthly samples of nutrients, phytoplankton, and zooplankton were taken from Columbia River estuary during 16 months to determine distribution with season and salinity, and interrelationships between plankton and nutrients. Nitrate and phosphate levels in river water entering the estuary are high in winter and are depleted in summer; silicate levels are high in the river water at all season. During summer upwelling season, nitrate and phosphate levels in the entering ocean water are high. Although nutrient levels in the estuary generally show linear relationship with salinity, nitrate and phosphate tend to be enriched in bottom waters of the central part of the estuary. Estuarine phytoplankton is primarily composed of freshwater species, probably representing a downstream extension of the river flora. Linear regression analysis indicates a strong correlation between phytoplankton abundance and solar radiation. Estuary zooplankton is composed of fresh water, oligohaline, and polyhaline forms. Eurytemore affinis (an oligohaline), the major zooplankter, reaches population densities of 100,000/cubic meter or more. Regression analysis indicates strong correlation between abundance of freshwater zooplankton and river temperature and close correlation between phosphate levels and Eurytemore abundance, exhibiting strong potential for zooplankton regeneration of phosphate necessary for phytoplankton growth. (Jones-Wisconsin)
W71-00666

ON THE STATISTICAL APPROACH TO ECOLOGICAL STUDIES OF MARINE BACTERIA (IN RUSSIAN),
Gidrometeorologicheskii Institut Odessa (USSR).
A. V. Tsyban, and V. A. Shaidman.
Doklady Academy of Sciences of USSR, Vol 188, No 5, p 1159-1162, 1969. 1 fig, 5 ref.

Descriptors: *Statistical methods, *Analysis, *Mathematical studies, *Marine bacteria, Temperature, Salinity, Distribution, Population.
Identifiers: *Prismatic ecograms, Black Sea, Thermo-halidic gradients.

The statistical method of prismatic ecograms is reported in application to the distribution of sea-inhabiting bacteria. The analysis is based on the two easily determinable parameters--temperature and salinity of water. The probability of 90% is accepted as the minimum significance for the frequency of occurrence of a species in relation to the thermo-halidic gradient. The study embraced the following heterotrophic bacteria of the Black Sea: Bacterium agile, B Liquifaciens, B galophilum, Chromobacterium aurantiacum, Pseudomonas sinuousa, Micrococcus aurantiacus, Bacillus solidus, B album, Micrococcus cinnabareus, B subtilis, M citreus, M candidus. The method is applicable for an appraisal of populations in relation to other ecological factors in any part of the biosphere. (Wilde-Wisconsin)
W71-00672

CHANGE OF C/N RATIO DURING THE COURSE OF DEVELOPMENT OF SPHAEROMA SERRATUM (CRUSTACEAN ISOPODE) (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 02K.
W71-00680

THE EFFECT OF SALINITY ON THE REMOVAL OF SOME ALIPHATIC KETONES,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 05C.
W71-00789

SAND INVENTORY PROGRAM. A STUDY OF NEW JERSEY AND NORTHERN NEW ENGLAND COASTAL WATERS,
Army Coastal Engineering Research Center, Washington, D.C.
David B. Duane.
Available from the NTIS as AD 703 583, $3.00 in paper copy, $0.95 in microfiche. Shore and Beach, October 1969, 5 p.
Identifiers: *Seacoast, Protection, *Sand, Beaches, Deposits, Stabilization, Gravel, Reflection, Maine, New Jersey, Pipes, Connecticut, Massachusetts, Coastal engineering, *Offshore sand deposits, Cape May (New Jersey), Beach stabilization, Shore protection, Pipelines.

CERC continues to seek and delineate offshore deposits of sand for beach restoration and stabilization. This Sand Inventory Program, in its exploration phase, uses seismic reflection profiles of the bottom and subbottom and also coring of the bottom. Laboratory analyses of the field data define the location, characteristics, extent, and quantity of the sand deposits that can be used for shore protection. CERC has conducted detailed exploration surveys off New Jersey, east Florida, New England, Long Island, and Norfolk, Virginia. This work covers 7,3000 miles of geophysical surveys and includes 1,037 cores and more than 5,000 sand-sample analyses. Within several miles of the shore and in water shoaler than 100 feet, the surveys revealed more than 4 million cubic yards of sand suitable for beach nourishment. In 1966, off New Jersey, the Corps of Engineers proved the practicability of recovering these sand deposits from the bottom and putting them on eroded beaches at a competitive cost. The work was accomplished by a large hopper dredge with a pump-out capability. More recently, a Federal beach near Los Angeles was artifically replenished by recovering an offshore deposit with a pipeline dredge.
W71-00791

SEDIMENT DISTRIBUTION AND HYDRODYNAMICS SACO RIVER AND SCARBORO ESTUARIES, MAINE,
Massachusetts Univ., Amherst. Coastal Research Group.
For primary bibliographic entry see Field 02J.
W71-00797

HYDROGRAPHY AND HOLOCENE SEDIMENTATION OF THE MERRIMACK RIVER ESTUARY, MASSACHUSETTS,
Massachusetts Univ., Amherst. Coastal Research Group.
Allan D. Hartwell.
Available from the NTIS as AD-709 144, $3.00 in paper copy, $0.95 in microfiche. June 1970, 181 p. Contribution No 5-CRG. NR 388-084.
Identifiers: *Hydrology, Massachusetts, *Rivers, Sedimentation, Geologic age determination, Environment, Sand, Particle size, Merrimack River, *Estuarine hydrography, *Holocene sedimentation.

The Merrimack River estuary, situated on glaciated terrain along the coast of northeastern Massachusetts, is representative of the Type B estuary of Pritchard (1955). A sharp, slightly tilted boundary between salt water to the north and fresh water to the south develops during periods of normal and high runoffs. At low runoff the stratification disappears. The distribution of bottom sediments is closely related to the hydraulic circulation pattern, tidal current velocities, bottom topography, and sediment source areas. Three types of sand are present in the estuary. A yellow-orange feldspathic suite occupies the main channel. A gray feldspathic suite underlines the marshes of the lower estuary. A third sand type, which is predominantly quartz (86%) with subequal amounts of gray and yellow-orange feldspar (5%), is common in the central part of the main channel and in some tidal channels. The stratigraphy and geometry of the deposits of the fringing salt marshes document a gradual rise in sea level and infilling of an original open bay environment behind the barrier island accompanying marine transgression since late Pleistocene.
W71-00798

HEAVY MINERAL INVESTIGATION OF CARMEL BAY BEACH SANDS,
Naval Postgraduate School, Monterey, Calif.
Paul Adolph Griffin.
Available from NTIS as AD 704 078, $3.00 in paper copy, $0.95 in microfiche. October 1969, 45 p. MS Thesis.
Identifiers: *Minerals, California, *Beaches, California, *Minerals, Analysis, Sand, Transport properties, Sampling, Petrography, Garnet

Geologic age determination, Seascoast, Theses, Carmel Bay, California, Littoral drift, *Heavy mineral analysis, Schists, Augites.

The investigation was conducted in order to identify the heavy minerals of the beach sands of Carmel Bay, and to analyze the distribution of these minerals. Carmel Bay offers the opportunity to study heavy mineral assemblages in a small isolated bay, internally divided by a submarine canyon, containing smaller pocket beaches influenced by several geological formations, and two fresh water streams. Correlation of the heavy mineral assemblage of each sample with the sample location clearly indicate that the beach sands can be divided into two principal mineral suites that are derivatives of the geological formations in immediate contact with the individual pocket beaches. The unique nature of each suite is preserved by natural obstructions that limit the influence of littoral drift and restrict the exchange of the beach sands.
W71-00809

LAND AGAINST THE SEA.
Army Coastal Engineering Research Center, Washington, D.C.

Available from NTIS as AD-453 227, $3.00 in paper copy, $0.95 in microfiche. May 1964, 43 p. Miscellaneous Paper No. 4-64.
Identifiers: *Beaches, Erosion, *Seacoast, Protection, Sand, Deltas, Bulkheads, Breakwaters, Hydrology, Tides, Law, Storms, Wind, Ocean waves, Ocean currents, Reinforcing materials, *Beach erosion, *Shore protection.

Described in non-technical language are the origin and nature of our sea coasts, the forces of which those coasts are exposed, the behavior of the shores under exposure to those forces, the effects thereon of development by man, and the characteristics of methods for the protection and improvement of the shore. Also described are the roles of the local, state, and federal governments in providing for sound development, protection and improvement of the shore, and discussion of the need of long-range planning for preservation of our coastal resources.
W71-00824

SEDIMENT BALANCE OF CLYDE ESTUARY,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
George Fleming.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7676, p 2219-2230, November 1970. 12 p, 7 fig, 3 tab, 8 ref.

Descriptors: *Estuaries, *Sedimentation, *Sediment yield, Dredging, Flood control, Floods, Sediment transport, Suspended load, Navigation, Data collections, Channel improvement.
Identifiers: Sediment balance.

The development of the Clyde Estuary in Scotland is considered in relation to its sedimentation. The historical facts relating to the changes in regime of the Estuary are listed to the present (1969) conditions. The results of 3 yr of detailed research into the sediment transport conditions of the major rivers draining into the Estuary include comparison of annual sediment loads computed by two different methods, the particle size of the transported sediment, and typical graphs of the weekly suspended sediment loads transported by the rivers Clyde, White Cart, and Kelvin. The historical development of the Clyde has affected the balance between the influences of tides, streamflow, cross-section geometry and sediment load on the deposition processes in the estuary. All the sediment entering the estuary deposits in the upper reaches. Reasonable agreement exists between the amount of sediment entering the estuary and the amount dredged. The contribution of sewage discharges and spillage to the total sediment load is significant, although their influence is of more major importance as pollutants, which reduce the dissolved oxygen levels and increase the BOD within the estuary. Cessation in present dredging operations could result in the occurrence of floods once more overtopping the banks of the Clyde adjacent to Glasgow. (Knapp-USGS)
W71-00844

BLACK SEA: RECENT SEDIMENTARY HISTORY,
Woods Hole Oceanographic Inst., Woods Hole, Mass.
For primary bibliographic entry see Field 02J.
W71-00855

CONCENTRATIONS OF PARTICULATE IRON IN ATLANTIC OPEN-OCEAN WATER,
Rhode Island Univ., Kingston. Narragansett Marine Lab.
For primary bibliographic entry see Field 02K.
W71-00867

CIRCULATION IN THE AMAZON RIVER ESTUARY AND ADJACENT ATLANTIC OCEAN,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
Ronald J. Gibbs.
Journal of Marine Research, Vol 28, No 2, p 113-123, May 15, 1970. 11 p, 6 fig, 3 tab, 12 ref. ONR Contract N00014-67-A-0111-0006.

Descriptors: *Saline water-freshwater interfaces, *Atlantic Ocean, *Estuaries, Ocean circulation, Ocean currents, Winds, Riverflow, Discharge (Water), Tides, Salinity, Mixing, Sea water, Freshwater, Stratification, Sampling.
Identifiers: *Amazon estuary (South America), *Isohalines, Salinometer.

A preliminary survey of the water circulation in the Amazon estuary and adjacent ocean was conducted during both low-river and high-river discharge. Results indicate that, due to the river's large discharge, no salt-water wedge (35 parts per thousand) enters the Amazon estuary during either low-river or high-river discharge. The zone of nearly vertical isohalines in the ocean near the river mouth represents an area of turbulent mixing. As the vertical mixing decreases seaward, a vertical stratification develops from about 60 km offshore during low-river discharge and from about 80 km offshore during high-river discharge. This stratification persists seaward across the continental shelf for 185 km during low-river discharge and for about 230 km during high-river discharge. During low-river discharge, an isolated freshwater lens was observed far off the French Guiana Coast. Related maps, graphs, and tables of data are included. (Woodard-USGS)
W71-00868

THE INFLUENCE OF DEPOSIT-FEEDING ORGANISMS ON SEDIMENT STABILITY AND COMMUNITY TROPHIC STRUCTURE,
Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics; and Marine Biological Lab., Woods Hole, Mass.
Donald C. Rhoads, and David K. Young.
Journal of Marine Research, Vol 28, No 2, p 150-178, May 15, 1970. 29 p, 19 fig, 44 ref. NSF Grants GB 7181, GB 4509, and GB 7387.

Descriptors: *Sedimentation, *Benthos, *Foods, *Trophic level, *Bays, Sediment distribution, Suspended sediment, Mud, Sampling, Silts, Organic matter, Currents (Water), Photography, Laboratory tests.
Identifiers: *Deposit-feeding organisms, Sediment properties, Buzzards Bay (Massachusetts).

Deposit-feeding and suspendion-feeding benthos in Buzzards Bay, Massachusetts, show marked spatial separation; suspension feeders are largely confined to sandy or firm mud bottoms while deposit feeders attain high densities on soft muddy substrata. Food source and bottom stability have been investigated as potential factors effecting this trophic-group separation. Observations were made at 11 stations along two widely separated transects over bottoms ranging in texture from silt to fine and medium sand. Water depths at these stations ranged from 3 m to 20 m. SCUBA divers made many of the field observations and collected most of the samples. This study included sampling of benthic macofauna, taking bottom photographs, analyzing sedimentary structures, texture, organic content and water content of the sediments, and measuring both water currents and suspended sediment above the bottom. Laboratory experiments were also carried out to determine differential resuspension between burrowed and unburrowed muds. (Woodard-USGS)
W71-00869

HOLOCENE SEDIMENTS OF THE PARKER RIVER ESTUARY, MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology.
Joan M. DaBoll.
Available from NTIS as AD-694493, $3.00 in paper copy, $0.95 in microfiche. Massachusetts University Department of Geology, Coastal Research Group Contribution No 3-CRG, June 1969. 138 p, 42 fig, 1 plate, 1 tab, 17 ref. Contract No Nonr N00014-67-A-0230-0001.

Descriptors: *Estuaries, *Massachusetts, *Sedimentation, Sediment transport, Sands, Sedimentary structures, Tides, Tidal effects, Currents (Water), Water circulation, Streamflow, Sand waves, Ripple marks.
Identifiers: Parker River Estuary (Mass).

The Parker River estuary is situated in glaciated terrain behind Plum Island, Massachusetts. It contains a meandering main channel, large point bars on the meander loops, and a complex flood-tidal delta system. The estuary is predominantly horizontally and vertically mixed, with a tendency toward slight horizontal salinity stratification. Ebb currents are stronger than flood currents in the main channel, whereas flood currents are stronger than ebb currents in the flood bifurcations off the main channel and over the tidal flats. Large bedforms (sand waves) are abundant in the sandy areas, and reflect the current pattern to a high degree. In general, grain size decreases toward the head of the estuary. The sediment falls into two populations, one from the main body of the estuary and the other from the tidal creeks. The main body population is nearly symmetrical to coarse skewed, moderately well to well sorted, and has graphic means between 1.25 and 2.90 phi. The tidal creek population is fine to very fine skewed, poorly sorted, and has graphic means ranging from 3.00 to 7.25 phi. (Knapp-USGS)
W71-00900

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

COMPARATIVE COST EVALUATION OF DESALTED WATER SUPPLY VERSUS ALTERNATIVE FRESHWATER SUPPLY FROM A CONVENTIONAL SOURCE,
Southwest Research Inst., Houston, Tex.
Donald E. Morris.
Water Resources Research, Vol 6, No 5, p 1487-1495, October 1970. 9 p, 5 tab, 5 ref, append.

Descriptors: *Desalination, *Water costs, *Cost-benefit analysis, *Saline water, *Water resources development, Water supply, Groundwater, Texas, Economics, Water wells, Aquifers, Water treatment, Water distribution (Applied), Water management (Applied).
Identifiers: Saline water resources.

A costing procedure was developed in Texas so that the cost of water produced by saline water conversion could be compared to the cost of an alternative freshwater supply from a conventional source. The cost of desalted water is generally higher than the cost of water from alternative sources. For desalting, the elements included in the costing procedure were: well fields for saline feedwater supply; intake system and pumping station; pipelines; pretreatment for saline water; the desalting plant; and brine disposal. For a conventional water supply system the elements of cost included were raw water cost; well field or intake system; pipeline and required pumping stations; and a conventional water treatment plant. The final economic justification of a desalination project may include such factors as chemical quality comparisons, secondary benefits, and project life comparison to future availability of alternative supply. The Texas Water Development Board considers that desalting is a very practical solution to the water supply problems that exist in many areas of the state. (Knapp-USGS)
W71-00569

NEED FOR SALINE GROUNDWATER DATA TO ADVANCE DESALTING TECHNOLOGY,
Office of Saline Water, Washington, D.C.
W. W. Rinne.
Water Resources Research, Vol 6, No 5, p 1482-1486, October 1970. 5 p, 2 tab, 6 ref.

Descriptors: *Water resources development, *Saline water, *Desalination, Groundwater, Aquifers, Systems analysis, Economics, Optimization, Injection wells, Waste water disposal, Brines, Brine disposal, Hydrogeology, Surveys, Reviews.
Identifiers: Saline water resources.

The use of desalting technology to supplement the water resources in semiarid areas of the United States indicates the need for more detailed information on the quantity and quality of saline groundwater supplies. The disposal of brine, a waste product of all desalting processes, poses a formidable problem at inland plant sites. Present work indicates that solar evaporation ponds and subsurface injection are the preferred methods of disposal. Injection, if employed, would require more data and information on the geologic and hydrologic features of subsurface formations. Systems studies relating the intake and brine disposal facilities with the desalting process are being conducted to achieve optimum system economics. (Knapp-USGS)
W71-00570

A REVIEW OF DESALINATION PROCESSES AND PRODUCT WATER COSTS,
Office of Saline Water, Washington, D.C.
W. F. Savage.
Water Resources Research, Vol 6, No 5, p 1449-1453, October 1970. 5 p, 4 fig.

Descriptors: *Desalination, *Water costs, *Desalination processes, *Reviews, *Surveys, Groundwater, Surface waters, Saline water systems, Desalination apparatus, Distillation, Reverse osmosis, Electrodialysis, Economics, Desalination plants.
Identifiers: Desalination costs.

The Office of Saline Water is conducting research and development in the basic desalination process areas of distillation, membrane, and crystallation. Processes in these areas include multistage flash distillation, vertical tube evaporation, vapor compression, reverse osmosis, electrodialysis, and vacuum freezing. Developmental plants have capacities up to approximately 2.5 million gallons per day. On the basis of test results, analytical studies, and supporting investigations, water costs have been reduced significantly over the past five years. Technological developments have resulted in a 25% reduction in water costs for distillation processes desalting seawater and a reduction by a factor of 3 for reverse osmosis processes desalting brackish water, considering a fixed plant size. Coupling of improved system technology with increasing plant size results in water costs that should be competitive with alternate means of supplying freshwater to major water consuming areas. (Knapp-USGS)
W71-00575

REORIENTATION OF OUR SALINE WATER RESOURCES THINKING,
Geological Survey, Washington, D.C.
F. A. Kohout.
Water Resources Research, Vol 6, No 5, p 1442-1448, October 1970. 7 p, 7 fig, 18 ref.

Descriptors: *Saline water, *Water resources development, *Desalination, Economics, Water costs, Groundwater, Saline water systems, Hydrogeology, Aquifers, Surveys, Reviews, Water storage, Injection wells, Water utilization, Water sources.
Identifiers: Saline water resources.

Desalination is currently one of the most important factors that conceptually change the direction of our investigation of the nations's water resources. Desalting costs have decreased from about $5 per 1000 gallons 10 years ago to about $1 per 1000 gallons for seawater distillation today. For membrane desalting of brackish groundwater, costs now range from 40 cents to $1 per 1000 gallons. Projected costs for desalting in the mid-1970's are in the range of from 25 to 50 cents per 1000 gallons at the plant, which is in the same range as consumer costs for delivered water in large cities in 1969. Thus, saline groundwater has developed considerable intrinsic worth. In addition, the pore space occupied by the saline water can be considered as a useful medium for storing natural gas, for artificial recharge, or for storing toxic industrial wastes. Great reliance must be placed on hydrologic prediction if haphazard interference of the various uses is to be avoided. Funding must be greatly expanded to provide necessary data on saline water systems. (Knapp-USGS)
W71-00576

HIGH-TEMPERATURE DESALINATION PLANTS FOR NUCLEAR-POWER STATIONS,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
R. A. Tidball, and J. G. Gaydos.
In: Nuclear Desalination - Proceedings of International Atomic Energy Agency Symposium, Madrid, Spain, November 18, 1968, p 495-506, Paper No SM-113/26, 1969. 12 p, 11 fig, 5 ref.

Descriptors: *Desalination plants, *Nuclear power plants, Facilities, Economics, Water costs, Distillation, Water quality, Sea water, Scaling.
Identifiers: Sea-water desalination.

The maximum temperature to which the brine can be heated in a MSF plant affects both the capital costs and energy costs charged to the product water. At the OSW East Coast Test Facility fresh sea water can be treated with sulphuric acid and heated in a 'once-through' plant to 300 deg F without scale formation in the condenser tubes. When this sea water is recirculated with or without concentration, scaling will occur at temperatures above 270 deg F. A combination of a 'once-through' high-temperature effect with either a single-effect multi-stage (SEMS) flash plant or a multi-effect multi-stage (MEMS) flash plant can be utilized to reduce both capital cost and energy charges. The purity of the product water from most MSF plants varies between 5 and 100 ppm TDS. Purer water can be made at an increase in capital cost. Make-up water for modern fossil-fuel boilers or for primary systems of nuclear reactors require water containing as little as 0.05 ppm. Generally, a small part of the product water of a desalination plant is passed through a demineralizer to obtain the desired purity for make-up. However, a method is available to produce a few percent of the total product as very high-purity water. This process is presented and included in the design of the proposed plants. The capital charges, energy charges and chemical charges are compared for 150-MGD plants using the SEMS, MEMS and the 'once-through' topping plant in combination with both. (Knapp-USGS)
W71-00614

DESALTING SALINE GROUNDWATER FOR IRRIGATION: A CASE STUDY, BUCKEYE, ARIZONA,
Bureau of Reclamation, Denver, Colo.; and Office of Saline Water, Washington, D.C.
Harold L. Parkinson, John T. Maletic, Joseph P. Wagner, and Milton S. Sachs.
Water Resources Research, Vol 6, No 5, p 1496-1500, October 1970. 5 p, 2 fig, 2 tab, 6 ref. Bureau of Reclamation and Office of Saline Water Research agreement 14-01-0001-1241.

Descriptors: *Irrigation water, *Desalination, *Cost-benefit analysis, *Arizona, Saline water systems, Groundwater, Water wells, Salinity, Saline water, Aquifers, Water yield, Water costs, Optimization, Model studies, Economics.
Identifiers: Saline water resources.

A study was made of a 1,376 acre irrigated area in Arizona to evaluate costs and benefits associated with desalting saline groundwater from seven wells as an improved water source for irrigation. Both multistage flash distillation (MSF) and electrodialysis (ED) processes were evaluated. Well water quality varied from 1580-4600 ppm; irrigation water qualities of 400, 900, and 1500 ppm are developed. Adaptable cropping patterns are selected for maximum returns. Direct, indirect, and public benefits for the projected year of 1990 are generated by shifts to higher value crops, intensive double cropping, increased crop yields, reduced water use, reduced fertilizer costs, reduced irrigation labor, and from increased flow of farm products. Costs are based on the desalting facilities, well water collection system, product storage reservoir, conveyance and distribution system, brine disposal system, blending facilities (MSF only), gypsum addition system (ED only), and water treatment facilities. Benefit-cost ratios increased with improved water quality. The most favorable benefit-cost ratio involved use of the ED process at a water quality level of 500 ppm. (Knapp-USGS)
W71-00837

SELECTIVE ELEMENT RECOVERY FROM OIL FIELD BRINES,
Kansas Univ., Lawrence.
Ernest E. Angino.
Water Resources Research, Vol 6, No 5, p 1501-1504, October 1970. 4 p, 4 fig, 1 tab, 9 ref.

Descriptors: *Oil fields, *Brines, *Byproducts, *Brine disposal, *Desalination, Water resources development, Oil industry, Injection wells, Costs, Water chemistry, Magnesium, Sulfur, Saline water.
Identifiers: Oil field brines, Saline water resources.

More than 325 billion gallons of oil field brines are brought to the surface yearly in the United States. In many instances the salts dissolved in oil field brines could be extracted profitably, if modern extraction techniques were used or refined. Simple extraction processes for soda ash, sodium carbonate, caustic soda, magnesium and calcium sulfate, trace elements and others are available. Magnesium can be precipitated in the hydroxide form and selected trace elements can be scavenged and concentrated by ferric iron precipitation. (Knapp-USGS)
W71-00841

ST. THOMAS 2.5 MGD COMBINED DESALINATION-POWER PLANT,
Baldwin-Lima-Hamilton Corp., Wrightsville Beach, N.C.
Robert A. Tidball.
Paper presented at PURAQUA, US Exhibition and International Conference on Water Purification

and Desalination, Rome, Italy, February 17-23, 1969. 5 p, 13 fig.

Descriptors: *Desalination plants, *Water costs, *Flash distillation, *Thermal powerplants, Virgin Islands, Economics, Desalination processes, Distillation, Steam turbines.
Identifiers: St. Thomas (V. I.).

The overall heat balance material balances, and economics for the combined power and desalination station at St. Thomas, Virgin Islands are summarized. The boiler is fired with 18,140 lbs. per hour of residual fuel oil. 233,093 lbs. per hr. of the 600 psig 825 deg F. steam is piped to the turbine generator set which produced 15,500 KW of saleable power. Bleed steam is removed at 26 psig and piped to the brine heater of the desalting plant, which produces 2,500,000 gpd of potable water. The water plant was designed to produce water containing less than 10 ppm total dissolved solids, using not more than 110,000 lbs./hr. of bleed steam from the turbine. Scaling of the heat transfer surfaces in the stage condensers and the brine heater was to be prevented by the use of sulfuric acid treatment to the make-up stream. The plant was designed for a 90% availability factor. The total cost is $641,000.00 per year. During the year, the plant could produce 825,000,000 gallons of water at a cost of 78 cents/thousand gallons. (Knapp-USGS)
W71-00890

OPERATING EXPERIENCES OF ONE MGD DESALINATION PLANT ON THE RED SEA,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
R. A. Tidball, J. G. Gaydos, and W. M. King.
Paper presented at Symposium on Western Water and Power, Los Angeles, Calif, April 8-9, 1968, p C43-C49, 1968. 7 p, 6 fig, 2 ref.

Descriptors: *Flash distillation, *Thermal power plants, *Water costs, Economics, Distillation, Corrosion, Desalination processes, Desalination plants.
Identifiers: Eilat (Israel).

A one MGD desalting plant was erected in conjunction with a 6700 kilowatt steam generating station in Eilat, Israel. The design, manufacture and construction of the plant are discussed. The operating history and performance of the first 2-1/2 year period are summarized. The effects of brine chemistry on corrosion, scaling and heat transfer are discussed with methods of selecting proper operating conditions. No calcium nor magnesium scale deposits have formed at any point in the system. The results of the corrosion tests, chemical analyses and visual inspection indicate that the plant should have an operating life in excess of thirty years. From December 21, 1965 to December 30, 1966 the plant produced 349 million gallons or 93% of the design capacity on a continuous basis. On a daily basis, the plant actually averaged 110% of design capacity. However, scheduled downtime for maintenance, along with periods when there was no demand for water, reduced the total annual production. From January 1, 1967 to the present, the plant has averaged about 105% of design. (Knapp-USGS)
W71-00896

SCALE CONTROL CUTS DESALTING COSTS...INCREASING PLANT OUTPUT BY 25 PERCENT,
Baldwin-Lima-Hamilton Corp., Wrightsville Beach, N.C. Industrial Equipment Div.
Robert A. Tidball.
Reprint from The American City, January 1967. 3 p, 3 fig, 2 photo.

Descriptors: *Desalination, *Pilot plants, *Sea water, Scaling, Flash distillation, Research and development.
Identifiers: *Scale control, *Thermal efficiency, Wrightsville Beach (NC).

A 25,000 gpd scale control, flash-distillation unit for desalting sea water was developed at Wrightsville Beach, N. C. The plant consists of two fabricated steel shells four feet in diameter and 35 feet long. Each contains two passes of four stages each for a total of 16 stages. With a 3 degree flashing range per stage, the plant can simulate any 16 consecutive stages operating over any 50 deg range between 100 and 400 deg F. The heat balance and operating flow of the pilot plant is illustrated. Results indicate that scale-free operation can be expected at 250 deg F in a recycle system with double strength sea water, and at 282 deg F with single strength sea water. In a once-through system, scale is not encountered below 300 deg F. (Woodard-USGS)
W71-00897

METHODS FOR SCALE CONTROL IN FLASH SYSTEMS,
Baldwin-Lima-Hamilton Corp., Wrightsville Beach, N.C. Seawater Research Lab.
R. A. Tidball, and R. E. Woodbury.
Paper presented at 1st International Symposium on Water Desalination, Wash, DC, October 1965. 7 p, 10 fig, 6 ref.

Descriptors: *Desalination, *Methodology, *Sea water, Scaling, Flash distillation, Research and development.
Identifiers: *Sea-water conversion, *Scale control, *Thermal efficiency.

Methods used to retard or prevent the formation of scale in sea-water evaporators described and evaluated. Pertinent diagrams included: (1) Thermal Diagram - Multi-Stage Recylce Flash Plant; (2) Solubility Curves of Scaling Compounds; (3) Scaling Conditions - pH Control; (4) Mechanism of Scale Formation in Submerged Tube Plants; (5) Mechanism of Scale Formation in Flash Plants; (6) Variation of Interfare Temperature with Mean Temperature Difference; (7) Variation of Interface Temperature with Brine Velocity; (8) Change in Heat Transfer with Time Seeding Techniques - Max. Brine Temp. 250 deg F; (9) Flow Sheet Showing Typical pH Scale Control System; and (10) Mems Plant Incorporating A 'Once Through' Effect and High Temperature Treatment of Make up Water. (Woodard-USGS)
W71-00899

3B. Water Yield Improvement

QUANTITATIVE MAPPING OF SALINITY, VOLUME, AND YIELD OF SALINE AQUIFERS USING BOREHOLE GEOPHYSICAL LOGS,
Geological Survey, St. Louis, Mo.; and Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C.
W71-00571

THEORETICAL ESTIMATES VERSUS FOREST WATER YIELD,
West Virginia Univ., Morgantown. Div. of Forestry.
R. Lee.
Water Resources Research, Vol 6, No 5, p 1327-1334, October 1970. 8 p, 3 tab, 27 ref.

Descriptors: *Rainfall-runoff relationships, *Water balance, *Water yield, *Mathematical models, Data collections, Streamflow, Percolation, Forests, Forest management, Safe yield, Surface drainage, Watershed management, Vegetation effects.
Identifiers: Forest hydrology.

Theoretical and empirical models used to estimate the long-term water balance of small catchments are inadequate as a check on the observed water balance. Under rigorous research conditions, the observational data are accurate to about 13-30% of yield, while the models are accurate only to about 10-60% of yield. Analysis of watershed data shows that the uncertainty in any comparison of theoretical and observed values usually is much greater than the difference between the values compared. In general, such comparisons are not helpful either in confirming or challenging the accuracy of water balance measurements, or in assessing the water-tightness of catchment areas. (Knapp-USGS)
W71-00587

RAINFALL ENHANCEMENT BY DYNAMIC CLOUD MODIFICATION,
Environmental Science Services Admin., Miami Univ., Coral Gables, Fla.; and Atlantic Oceanographic and Meteorological Lab.
William L. Woodley.
Science, Vol 170, No 3954, p 127-132, October 9, 1970. 6 p, 4 fig, 2 tab, 25 ref.

Descriptors: *Cloud seeding, *Artificial precipitation, *Silver iodide, Cloud physics, Weather modification, Florida, Convection, Environmental effects, Nucleation, Atmospheric physics.
Identifiers: *Dynamic cloud modification, Rainfall enhancment.

The relevance and reliability of seeding technology for practical uses are discussed and the results of a new experimental approach are given, in which massive silver iodide seeding caused rainfall increases from single clouds over southern Florida. In the Florida experiments, 19 clouds were used, 14 for seeding and 5 for control. Twenty 50-gram silver iodide pyrotechnics were dropped from aircraft into each cloud--10 on each of two mutually perpendicular passes near cloud top. The seeded clouds grew an average of 3,500 m more than the controls. Precipitation varied widely from cloud to cloud and from day to day, but seeded clouds rained twice as much as the unseeded clouds. Radar was the main tool for precipitation evaluation. In seeding for precipitation increases there are two approaches, static and dynamic, each involving different techniques and amounts of seeding material. Results depend on the initial conditions of the cloud-environment system. (Lang-USGS)
W71-00854

PRELIMINARY EVALUATION OF AVAILABILITY OF POTABLE WATER ON ELLIOTT KEY, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
H. Klein.
Geological Survey Open-file Report 70010, 1970. 15 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Water resources development, Water supply, *Fresh water, *Water resources, *Water management (Applied), *Florida, National parks, Rainfall, Groundwater, Shallow wells, Aquifers, Geology, Limestones, Salinity, Water storage, Water quality, Chlorides, Water analysis, Desalination.
Identifiers: Cisterns, Catchments.

The National Park Service is arranging for the purchase of Elliott Key and adjacent smaller keys in the upper Florida Keys, southeast of Miami, for the proposed Biscayne National Monument. Reviewed possibilities of potable water supplies that will be required in Elliott Key include shallow wells and water storage facilities during the rainy season; roof runoff into cisterns; paved catchments; blending water from different sources; and desalination of brackish water from the Floridan aquifer. Probably the most practical method is desalination. This is based on information on an artesian well drilled to 1,330 feet at the Pennekamp State Park in middle Key Largo and the reasonable cost of desalination by reverse osmosis. (Woodard-USGS)
W71-00881

ANNUAL REPORT OF PHREATOPHYTE ACTIVITIES - 1968,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Philip M. Turner.

Bureau of Reclamation Report REC-OCE-70-27, July 1970. 21 p, 9 tab, 54 ref.

Descriptors: *Phreatophytes, Water resources, *Weed control, Ecology, *Water conservation, Evaporation, *Evapotranspiration, Vegetation, Water measurement, Forestry, Semiarid land, Lysimeters, *Herbicides, Prototype tests, Bibliographies, Consumptive use, Transpiration, Surfactants, Evaluation, *Tamarisk.

Bureau of Reclamation activities on phreatophyte research and control are described. Regional research contracts have been negotiated with universities in Arizona and Nevada. At Denver, Colo, saltcedar plants are greenhouse- and nursery-cultured and used as test specimens for foliar-applied herbicides. Herbicides are evaluated on saltcedar in plots along the Arkansas River near North Avondale, Colo. Helicopter herbicide spraying was performed on 920 acres (372 ha) of saltcedar at Rye Patch Reservoir by the Bureau and the Pershing County Water Conservation District. 14,000 acres (5,667 ha) of phreatophytes have been removed from the Colorado Indian Reservation near Parker, Ariz., since 1965. Phreatophytes have been controlled by tree crusher, root plow, cutter dozer, and spraying on 38,600 acres (15,645 ha) along the Pecos River in New Mexico.
W71-00911

CLOUD SEEDING, AREA OF EFFECT NUMERICAL MODEL,
Aerometric Research, Inc., Goleta, Calif.
For primary bibliographic entry see Field 02B.
W71-00912

SYNTHETIC HYDROPHOBIC SOILS FOR HARVESTING PRECIPITATION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Dwayne H. Fink, and Lloyd E. Myers.
In: Symposium on Water-Repellent Soils, Proceedings, University of California, Riverside, May 6-10, 1968, Pub March 1969, p 221-240. 7 fig, 2 tab, 8 ref.

Descriptors: *Soil sealants, *Arid lands, *Precipitation (Atmospheric), *Runoff, *Water harvesting, Water conservation, Reservoirs, Soil physical properties, Soil texture, Porosity, Capillary action, Soil investigations, Soil structure, Soil water movement, Particle size, Soil surfaces, Repellents.
Identifiers: *Water-repellent soils, *Hydrophobic compounds, *Catchments, *Breakthrough pressure, Waterdrop contact angle, Effective soil pore radius, Silicones.

In areas of chronic water deficit improved runoff catchments coated with hydrophobic soils may be extremely useful. Of the many chemicals capable of creating water repellency in soils, sodium methylsilanolate (R-20) is the most promising and experiments were therefore undertaken to gauge its effectiveness. Soil breakthrough pressure (h) is directly proportional to the water drop contact angle and inversely proportional to the effective pore radius of the soil. Methods are described for measuring breakthrough pressure, contact angle, effective pore radius, soil particle size and soil surface areas in R-20 treated soils. Results showed that h increased directly with organic coverage and that sandy soils may be more effectively treated than finer textured soils because of their smaller surface area. All soils tested obtained an optimal monolayer coverage of 0.00003 grams R-20 per square meter of soil. At and beyond monolayer coverage the contact angle was relatively constant and about 150 degrees. Evaluation criteria and substances inducing soil repellency are discussed. (Casey-Arizona)
W71-00962

3C. Use of Water of Impaired Quality

SALINE GROUNDWATER RESOURCES OF THE CONTERMINOUS UNITED STATES,
Geological Survey, Menlo Park, Calif.
J. H. Feth.
Water Resources Research, Vol 6, No 5, p 1454-1457, October 1970. 4 p, 4 ref.

Descriptors: *Saline water, *Water resources development, *Reviews, Surveys, Saline water systems, Desalination, Desalination processes, Economics, Water costs, Groundwater basins, Surface waters, Groundwater, Hydrogeology.
Identifiers: Saline water resources.

Saline water is arbitrarily defined as water containing more than 1000 milligrams per liter of dissolved solids. Saline groundwater is known to underlie about two-thirds of the 48 states. Locally, aquifers yield saline groundwater in profuse quantities, some of which is used by industry, particularly for cooling. Generally, however, saline water has been considered a nuisance. In this report it is dealt with as a resource, especially for the future. Forty chemical types of mineralized groundwater were recognized, but sodium chloride dominates the occurrences and is almost the only type found where concentrations exceed about 20,000 mg/liter. The occurrence and hydrologic properties of saline water aquifers deserve much more study than they have had. (Knapp-USGS)
W71-00574

EFFECT OF VARIOUS SALINITY REGIMES ON GROWTH, LEAF EXPANSION AND TRANSPIRATION RATE OF BEAN PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcano Institute of Agricultural Research; and Hebrew Univ. of Jerusalem (Israel).
A. Meiri, and Alexandra Poljakoff-Mayber.
Grant No. A10-SWC-7; FS-Is-179 from the U. S. Department of Agriculture. Soil Science, Vol 109, No 1, p 26-34, January 1970. 5 fig, 5 tab, 20 ref.

Descriptors: *Beans, *Salinity, *Plant growth, *Transpiration, *Leaves, Saline soils, Saline water, Salts, Salt tolerance, Semiarid lands, Sodium chloride, Irrigation water, Irrigation effects, Growth rates, Soil-water-plant relationships, Moisture content, Greenhouses.
Identifiers: *Leaf water content, *Irrigated agriculture, *Seedlings.

Bean seedlings in a greenhouse were subjected to various fluctuating salinity regimes in order to simulate field conditions occurring in areas with saline soils or saline water. Plant growth was retarded in all cases and transpiration was reduced by, and in proportion to, salinity. Leaf water content appeared to exert a strong influence on growth and transpiration. Growth retardation was found to be dependent on salinization rate, ultimate salinity level, and duration of seedling exposure to saline conditions. When plants were transferred from a saline to a non-saline medium, they demonstrated a transient burst of growth and an increase in transpiration rate. The seedlings, however, never reached the growth and transpiration levels of non-salinized control plants. The data indicate that under normal field conditions fluctuating salinity regimes will affect plant growth and transpiration less severely than, but similarly to, the constant salinity levels used in most experiments. (Carr-Arizona)
W71-00685

3D. Conservation in Domestic and Municipal Use

AREAWIDE WATER AND SEWER PLAN: COMPREHENSIVE PLANNING STUDY, CROSSETT, ARKANSAS.
Crossett Ashley County Joint Planning Commission, Ark.
For primary bibliographic entry see Field 05G.
W71-00788

SEWER AND WATER FACILITIES ANALYSIS.
Capital District Regional Planning Commission, Albany, N.Y.
For primary bibliographic entry see Field 05G.
W71-00790

REGIONAL WATER PLAN, PART I.
Heart of Texas Council of Governments, Waco.
For primary bibliographic entry see Field 06D.
W71-00794

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 06D.
W71-00804

RICHMOND REGIONAL SEWERAGE PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00805

RECOMMENDED REGIONAL PLAN FOR SEWERAGE, WATER SUPPLY AND STORM DRAINAGE.
Valley Regional Planning Agency, Ansonia, Conn.
For primary bibliographic entry see Field 06B.
W71-00819

A MASTER WATER PLAN FOR UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.

Available from NTIS as PB-192 856, $3.00 in paper copy, $0.95 in microfiche. April 1970, various pagings.
Identifiers: *Management planning, New Jersey, *New Jersey, *Water supplies, Analysis, Sources, Distribution, Statistical data, Feasibility studies, *Union County (New Jersey), Area planning and development, Water consumption.

The report presents A Master Water Plan for Union County, New Jersey. It includes the analysis of existing sources of supply and distribution system, as presented in the First Stage Report entitled 'Report Upon Water Supplies and Water Facilities in Union County' which has previously been submitted and approved. In this report, the adequacy of existing facilities is analyzed by comparing the safe yield of the existing sources of supply to the present and projected future water consumption. The ability of the existing distribution systems to meet the present and future demands has also been investigated. Recommendations for both short-term and long-range improvements are made. (See also W71-00826)
W71-00825

WATER SUPPLIES AND WATER FACILITIES IN UNION COUNTY.
Union County Planning Board, N.J.

Available from NTIS as PB-192 836, $3.00 in paper copy, $0.95 in microfiche. June 30, 1969, 39 p. Supplement, October 14, 1969, p 40-42.
Identifiers: *Management planning, New Jersey, *New Jersey, *Water supplies, Storage, Sources, Pipes, Chemicals, Water pollution, Storage tanks, Costs, Tables, Statistical data, Maps, *Union County (New Jersey), Area planning and development, *Water facilities.

The report is the first stage of a report dealing with utilities of Union County. The report includes: description of present water supply systems serving municipalities in Union County, including sources of supply, distribution systems and storage systems. The report is intended to describe the existing facilities. In addition the report contains basic data with regard to major pipelines, existing treatment facilities, location of storage tanks and other appurtenances which comprise the general inventory of the utilities. The report indicates the capacity and utilization of existing facilities as well as a determination of the existing facilities as well as a determination of the existing facilities capable to serve present requirements. (See also W71-00827)
W71-00826

STORM DRAINAGE FACILITIES, UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.

Available from NTIS as PB-192 822, $3.00 in paper copy, $0.95 in microfiche. May 1970, various pagings.
Identifiers: *Management planning, New Jersey, Floods, Drainage, Storms, Structures, Rainfall, Storage, Fluid flow, Rivers, Design, Tides, Pipes, Inland waterways, Roads, Maps, *Union County (New Jersey), Area planning and development, Storm sewers.

The report presents an inventory and analysis of the storm drainage facilities of Union County, New Jersey. Points of analysis were generally selected where streams cross major County thoroughfares. The tributary area to each of these points were determined. Estimates of minimum design flows were prepared. These suggest minimum design flows were then used to determine the adequacy of the existing drainage facility at the point of analysis. The second stage of this report will analyze tidal influence upon storm drainage facilities and present a recommended plan of improvements. (See also W71-00825)
W71-00827

WATER SUPPLY AND SEWAGE DISPOSAL.
Rensselaer County Dept. of Planning and Promotion, Troy, N.Y.

Available from NTIS as PB-192 431, $3.00 in paper copy, $0.95 in microfiche. 1968, 110 p. HUD Project N.Y. P-168.
Identifiers: *Management planning, New York, Water supplies, Statistical analysis, *Sewage, Disposal, Population, Volume, Costs, Analysis, Statistical data, Urban areas, Rural areas, Storms, Drainage, Maps, *Rensselaer County (New York), Area planning and development, *Cost analysis.

These facilities have been separately examined but are included in a single report. The section of water supply consists of a basic inventory of the existing water systems, their capacity, the number of people served, and the per capita consumption. Also presented is a cost analysis for each community serviced. The section on sewers includes an inventory of the existing sewers and storm water facilities and explanations of the districts proposed by the County, one of the towns, and by three of the villages. Appropriate maps and cost estimates for the new districts are also included.
W71-00828

3E. Conservation in Industry

AREAWIDE WATER AND SEWER PLAN: COMPREHENSIVE PLANNING STUDY, CROSSETT, ARKANSAS.
Crossett Ashley County Joint Planning Commission, Ark.
For primary bibliographic entry see Field 05G.
W71-00788

MANAGING THE NATURAL ENVIRONMENT: A REGIONAL PLAN FOR WATER, SEWAGE, AIR AND REFUSE,
Tri-State Transportation Commission, New York.
For primary bibliographic entry see Field 05G.
W71-00829

SELECTIVE ELEMENT RECOVERY FROM OIL FIELD BRINES,
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 03A.
W71-00841

WATER POLLUTION CONTROL CREATES DEMAND FOR GROUNDWATER HYDROLOGISTS,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 05G.
W71-00848

QUANTITATIVE ANALYSIS OF INDUSTRIAL WATER-USE PATTERNS IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 06D.
W71-00902

3F. Conservation in Agriculture

STEADY INFILTRATION FROM LINE SOURCES AND FURROWS,
Agricultural Research Service, Madison, Wis., and Wisconsin Univ., Madison. Coll. of Agriculture.
For primary bibliographic entry see Field 02G.
W71-00558

LEACHING OF CROP RESIDUES AS A SOURCE OF NUTRIENTS IN SURFACE RUNOFF WATER,
Agricultural Research Service, Morris, Minn.; and Minnesota Univ., Morris.
For primary bibliographic entry see Field 05B.
W71-00584

FERTILIZER USE AND WATER QUALITY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05A.
W71-00639

RISING WATER VALUES THAT RESULT FROM INCREASED MOBILITY,
Utah State Univ., Logan. Dept. of Agricultural Economics.
B. Delworth Gardner, and Herbert H. Fullerton.
Available from NTIS as PB-195 311, $3.00 in paper copy, $0.95 in microfiche. Bulletin, 476, October, 1968. 27 p, 6 tab, 3 fig. OWRR Project B-009-UTAH (9).

Descriptors: *Water transfer, Water rights, Utah, *Irrigation, Institutions, *Costs, *Rent, Evaluation.

This bulletin indicates the gains in the value of water that occurred in one irrigation district in Utah when transfers were permitted between irrigation companies after many years of the typical practice of restricting transfers to those within a given company. The exposition presents a description of the institutional setting before and after the transfer impediment was relaxed; a discussion of the development of the rental market; appraisal of the relation between transfer flexibility and economic efficiency; reporting of rental values and an identification of the variables influencing rental values; and presentation of the statistical results.
W71-00684

EFFECT OF VARIOUS SALINITY REGIMES ON GROWTH, LEAF EXPANSION AND TRANSPIRATION RATE OF BEAN PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcano Institute of Agricultural Research; and Hebrew Univ. of Jerusalem (Israel).
For primary bibliographic entry see Field 03C.
W71-00685

THE GOLODNAYA STEPPE: A RUSSIAN IRRIGATION VENTURE IN CENTRAL ASIA,
Michigan State Univ., East Lansing. Dept. of Geography.
Ian M. Matley.
Geographical Review, Vol 60, No 3, p 328-346, July 1970. 3 fig, 28 ref.

Descriptors: *Water utilization, *Arid lands, *Irrigation canals, *Cotton, *Economic feasibility, Government finance, Diseconomies of scale, Depreciation, Economic efficiency, Project planning, History, Economic justification, Financial feasibility, Project feasibility, Concrete-lined canals, Irrigation canals, Canal construction, Salinity, Irrigation systems, Feasibility studies, Crop production.
Identifiers: *Soviet Union, *Turkmenian Desert, *Golodnaya Steppe.

The Golodnaya Steppe in Turkestan is an arid, fertile rolling plain of about 700-800 feet elevation bordering a long river, the Syr Darya. In 1870 the Czarist authorities began long range feasibility studies on extensive irrigation projects in the area in order to eliminate national dependence on imported cotton. The construction and improvements of various canal systems over the next 45 years are described. By 1916, 35,000 hectares were under irrigation, but problems of salinity, waterlogging and malaria had developed and the economics of the scheme were in doubt. Although the irrigated land fell into disuse during the revolution, the Soviet government continued the project with an eventual goal of 500,000 hectares. By 1940, 138,000 hectares were under irrigation, of which 63,000 hectares were in cotton with an average yield of 1770 kilograms per hectare. In 1967, 300,000 hectares were irrigated, but the old problems of salinity were worsening and yield per acre had declined considerably. Despite the enormous investment in the project by the Soviets, increases over achievements of the Czarist government were relatively small in comparison to cost and the goal of independent cotton production may be economically unrealistic. (Casey-Arizona)
W71-00692

METHOD FOR DISCHARGE MEASUREMENTS IN IRRIGATION OUTLETS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
M. H. Diskin.
Journal of Agricultural Engineering Research, Vol 13, No 4, p 350-357, December 1968.

Descriptors: *Discharge measurements, *Discharge (Water), *Outlets, *Pipe flow, *Irrigation engineering, Flow measurement, Pipes, Flowmeters, Equations, Hydraulics, Irrigation, Irrigation water.
Identifiers: *Critical depth, *Depth of flow, *End depth, *Irrigation outlets.

Discharge from irrigation outlet pipes (horizontal circular channels) was calculated by measuring the depth of flow at a station located 5.2 D from the end of the outlet. In experiments on 6, 8, 10, and 16 in. pipes, discharge was found to be functionally related to depth at the measuring station. The equation expressing this relationship is Q/ (g D super 5) super 1/2 equals 0.884 (h sub s/D) super 2.23, where Q is channel discharge, g is acceleration due to gravity, D is diameter of the circular channel, and h sub s is depth of flow at the measuring station. Small flow disturbances at the end of the outlet do not affect the relationship. This new method of calculating discharge from irrigation outlets appears to overcome some of the difficulties of two presently used methods, since it does not require any attachments to the end of the pipe and the measuring station is located upstream of the end section. (Carr-Arizona)
W71-00694

NITROGEN AND PHOSPHORUS FERTILIZATION FOR PRODUCTION OF CRESTED WHEATGRASS AND NATIVE GRASS IN NORTHEASTERN MONTANA,
Agricultural Research Service, Bozeman, Mont. Northern Plains Branch; and Montana Agricultural Experiment Station, Bozeman.
For primary bibliographic entry see Field 02I.
W71-00695

AMITROLE RESIDUES AND RATE OF DISSIPATION IN IRRIGATION WATER,
Agricultural Research Service, Denver, Colo. Crops Research Div.; and Agricultural Research Service, Prosser, Wash. Crops Research Div.
Robert J. Demint, Peter A. Frank, and Richard D. Comes.
Weed Science, Vol 18, No 4, p 439-442, July 1970. 3 fig, 4 tab, 5 ref.

Descriptors: *Aminotriazole, *Irrigation water, *Irrigation canals, *Laterals, *Aquatic weed control, Herbicides, Weed control, Irrigation, Irrigation ditches, Washington, Colorado, Sampling.
Identifiers: *Herbicide residues, *Rate of dissipation.

A single ditchbank on two different canals were treated with 4.5 and 3.4 kg/ha of amitrole-T (amitrole-ammonium thiocyanate). Subsequent maximum concentrations of amitrole (3-amino-s-triazole) in the flowing water (1.13 and 0.65 cu m/sec) were 31 and 43 ppb, respectively. Both banks of another canal were treated before the turning of 1.42 cu m/sec of water into the canal, resulting in a maximum reading of 98 ppb of amitrole. Two hours after the main body of amitrole-bearing water had past the last sampling station, amitrole levels in each canal were down to 1 ppb or less. For distances up to about 14.5 km, amitrole dissipation in canals was a linear function of the herbicide concentration and the downstream flow. The dissipation rate was slowest when opposite canal banks were treated, medium when single banks were treated, and fastest when the herbicide was added directly to the water. Since amitrole is used to treat the banks of irrigation canals, this information should be useful when irrigation water is applied to crops which are intolerant of high herbicide levels. (Carr-Arizona)
W71-00698

IRRIGATION STUDIES ON COTTON: II. BOLL WEIGHT AND FIBRE PROPERTIES,
Central Arid Zone Research Inst., Jodhpur (India).
Kumar Vijay, and P. C. Raheja.
Annals of Arid Zone, Vol 8, No 1, p 105-108, 1970. 2 tab, 12 ref.

Descriptors: *Cotton, *Fibers (Plant), *Irrigation effects, *Soil moisture, *Arid lands, Crop production, Irrigation, Furrow irrigation, Sprinkler irrigation, Flood irrigation, Irrigation systems, Soil-water-plant relationships, Moisture availability.
Identifiers: *Irrigated agriculture, *Boll weight, Rajasthan (India).

Three varieties of long staple cotton, 216 F, H sub 14, and Andrews, were studied in western Rajasthan (India) in order to determine the effect of irrigation on boll weight and cotton fiber properties. Three soil moisture levels (0.3 atm, 0.6 atm, and 0.85 atm) and three irrigation methods (flat, furrow, and sprinkler) were tested in all possible combinations with the cotton varieties. The various boll and fiber characteristics of 216F and H sub 14 were quite similar. Both of the varieties yielded significantly higher boll numbers, dry weight of bolls per plant, ginning out turn, and strength of fiber than Andrews. However, Andrews showed higher 500-seed weight and mean fiber length than the other two varieties. Most fiber properties were not affected by the various irrigation methods, but fiber strength was significantly increased by flat irrigation over furrow irrigation in the first year. Soil moisture levels at 0.3 atm were superior to 0.85 atm for mean fiber length, but in 1963 the reverse was true for fiber strength. (Carr-Arizona)
W71-00703

IRRIGATION STUDIES ON COTTON IN ARID ZONE: I. EFFECT OF VARIOUS METHODS OF IRRIGATION AND LEVELS OF SOIL MOISTURE ON GROWTH AND YIELD OF THREE VARIETIES OF COTTON,
Central Arid Zone Research Inst., Jodhpur (India).
Kumar Vijay, and P. C. Raheja.
Annals of Arid Zone, Vol 8, No 1, p 98-104, 1970. 5 tab, 23 ref.

Descriptors: *Cotton, *Irrigation effects, *Soil moisture, *Plant growth, *Arid lands, Crop production, Irrigation, Furrow irrigation, Sprinkler irrigation, Flood irrigation, Irrigation systems, Moisture availability, Soil-water-plant relationships, Seeds.
Identifiers: *Irrigated agriculture, *Rajasthan (India).

Three varieties of long staple cotton, 216F, H sub 14, and Andrews, were studied in western Rajasthan (India) in order to determine the effect of irrigation on growth, yield, and quality of cotton. Three soil moisture levels (0.3 atm, 0.6 atm, and 0.85 atm) and three irrigation methods (flat, furrow, and sprinkler) were tested. Cotton variety Andrews appeared totally unsuited to arid climates. Varieties 216F and H sub 14 grew well and showed little difference in growth and yield characteristics. There was no marked difference in results between furrow and sprinkler irrigation. Both systems were consistantly superior to the flat method. Water availability to plants decreased progressively from 0.3 to 0.85 atm tension, significantly reducing plant growth and seed yield. It appears that irrigation between 0.3 and 0.6 atm is best. (Carr-Arizona)
W71-00704

ENGINEERING COST ANALYSIS FOR BEAVER IRRIGATION PROJECT.
Ozarks Regional Commission.

Available from NTIS as PB-191 695, $3.00 in paper copy, $0.95 in microfiche. 1970. 10 p, maps.
Identifiers: *Agriculture, *Aarkansas, *Irrigation systems, Costs, Water supplies, Natural resources, Dams, Feasibility studies, Statistical data, Systems engineering. Benton County (Arkansas), Washington County (Arkansas), Agricultural engineering.

The document contains an engineering analysis and report on development of a proposed water distribution system for irrigation in parts of Benton and Washington Counties, Arkansas. The report involves application of engineering techniques to investigate the cost to supply irrigation water to the project area with subsequent costs to distribute this water on-farm.
W71-00812

CONSUMPTIVE USE OF IRRIGATION WATER IN WYOMING,
Wyoming Univ., Laramie. Water Resources Research Inst.
Frank J. Trelease, Paul A. Rechard, Theodore J. Swartz, and Robert D. Burman.
Available from NTIS as PB-195 624, $3.00 in paper copy, $0.95 in microfiche. Wyoming Water Resources Research Institute, Water Resources Series No 19/Wyoming Water Planning Report No 5. July, 1970. 103 p, 4 tab, 7 fig, 2 maps, 10 ref, append. OWRR Project B-003-WYO (1).

Descriptors: *Consumptive use, *Irrigation practices, *Water use, *Planning, Effective precipitation, Climatic data, Evapotranspiration, Computer programs, Wyoming, Water resources development.

It is essential that irrigation water requirements and consumptive uses of water be known, when planning for water resource development at any level of government. The Blaney-Criddle Method of estimating consumptive use was chosen to provide guidelines of water use throughout Wyoming because it is widely accepted, is easy to use, and utilizes readily available climatic data. A digital computer program for solution of the method was prepared and data for fifty-six climatological stations in Wyoming are presented. (Rechard-Wyoming)
W71-00901

CATTLE FEEDERS AVOID POLLUTION BY USING WASTES IN IRRIGATION.
Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-00939

IRRIGATING WITH ANIMAL WASTE,
Soil Conservation Service, Hermiston, Oreg.
For primary bibliographic entry see Field 05G.
W71-00941

A RATIONAL APPROACH TO THE DESIGN OF CHECK SYSTEMS OF IRRIGATION,
Punjab Agricultural Univ., Hissar (India). Dept. of Agricultural Engineering.
V. V. N. Murty, and M. C. Agarwal.
Journal of Agricultural Engineering Research, Vol 15, No 2, p 163-170, June 1970. 3 fig, 2 tab, 4 ref.

Descriptors: *Irrigation design, *Percolation, *Soil moisture, *Soil physical properties, *Streamflow, Irrigation, Irrigation water, Surface irrigation, Hydraulics, Field capacity, Bulk density, Soil density, Infiltration, Wilting point, Equations, Mathematical models.
Identifiers: *Check irrigation, *Percolation losses.

A seven-step method is presented by which the size of check can be determined from known stream size and soil characteristics. The technique is supposed to overcome the inadequacies of the presently used Israelsen formula, especially in the area of percolation losses. Irrigation studies have shown that some percolation loss inevitably results when completely irrigating a plot, but this loss can be reduced by utilizing larger stream size. In this way percolation losses are lowered by reducing the time of initial water spread. A mathematical expression is derived for determining percolation losses under a given set of conditions. The article includes a nomograph for use in such a determination. (Carr-Arizona)
W71-00951

RECLAMATION OF A SALINE-ALKALI SOIL IN THE UPPER INDUS BASIN,
H. S. Zaidi, M. A. Nur-ud-din, K. D. Qayyum, and K. D. Gowans.
Pakistan Journal of Science, Vol 20, No 4, p 171-177, July 1968. 2 fig, 2 tab, 3 ref.

Descriptors: *Reclamation, *Saline soils, *Alkali soils, *Leaching, *Soil amendments, Soil profile, Soil chemical properties, Soil conservation, Gypsum, Rice, Calcium, Carbonates, Sodium, Solubility, Solutes, Organic matter, Ion exchan

Sampling, Salts, Soil analysis, Hydrogen ion conenration, Crop production, Wheat.
Identifiers: *West Pakistan, *Upper Indus Basin.

Soil profile analyses in the Upper Indus Basin of West Pakistan indicate that about 85% of the saltaffected soils are either saline-alkali or alkali. Reclamation by simple leaching is not feasible because of slowly soluble Ca carbonate which replaces exchangeable Na. Therefore, experiments were begun using amendments -- gypsum, S and organic matter-which increase Ca carbonate solubility. Plots on barren, salt-affected land were treated with either 2 or 5 tons gypsum/acre, 20 tons of barnyard manure/acre or 5 tons gypsum and 20 tons barnyard manure/acre. Some were left untreated. Subsequently, the plots were leached and planted to rice crops. Yields in terms of gross income minus amendments, were compared. They were significantly higher than those of untreated plots and the results indicated best success with the combination of 2 tons gypsum and 20 tons barnyard manure/acre. (Casey-Arizona)
W71-00952

IRRIGATED CASTORBEAN, SOYBEAN, AND SAFFLOWER TRIALS AT THE NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-00964

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

EQUATIONS FOR APPROXIMATING VERTICAL NONSTEADY-STATE DRAINAGE OF SOIL COLUMNS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W71-00552

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS, PART III -- THE RAY CATCHMENT AT GRENDON UNDERWOOD,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 02E.
W71-00591

FEASIBILITY OF A PERIODIC FLUSHING SYSTEM FOR COMBINED SEWER CLEANSING.
FMC Corp., Santa Clara, Calif. Central Engineering Labs.
For primary bibliographic entry see Field 05G.
W71-00623

THE GOLODNAYA STEPPE: A RUSSIAN IRRIGATION VENTURE IN CENTRAL ASIA,
Michigan State Univ., East Lansing. Dept. of Geography.
For primary bibliographic entry see Field 03F.
W71-00692

METHOD FOR DETERMINATION OF SAFE YIELD AND COMPENSATION WATER FROM STORAGE RESERVOIRS,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Bearch.
Tech Paper No 3, The Hydrologic Engineering Center, Corps of Engineers, US Army, Aug 1965. 15 p, 17 ref.

Descriptors: *Simulation analysis, *Reservoirs, *Reservoir operation, Optimization, Streamflow.

The trend toward multiple use of reservoir space and the consideration of prior rights and legal restrictions dictate that a detailed sequential analysis of inflows, outflows and operation factors be made. These principles are used in the determination of reservoir yield, regardless of the nature or type of water supply reservoir. Three types of reservoirs considered were designed for this report: (a) impounding reservoirs from which water supply is piped direct to destination, (b) regulating reservoirs from which water is released to the river for downstream use, and (c) pump storage reservoirs into which water is diverted or pumped from the river for future use. The basic procedure used throughout the United States consists of performing a reservoir routing or reservoir simulation study which require considerable time and effort. The general procedure for performance of a detailed project routing study was described. The steps included: (a) determination of non-project streamflow at each reservoir site and at downstream points of diversion, (b) determination of monthly firm supply, (c) determination of monthly reservoir stage limitations, (d) determination of expected average monthly evaporation and seepage loss, (e) development of the relation of river percolation losses to rate of flow, (f) development of the multireservoir operation criteria, (g) establishment of criteria for allowable shortages, (h) establishment of initial reservoir stage, and (i) performance of routing operation. Mentioned was the fact that considerable effort is being currently devoted to obtaining more dependable measures of potential streamflow by use of streamflow simulation procedures. Has 17 references. (Kriss-Cornell)
W71-00711

A HYDROLOGIC WATER RESOURCE SYSTEM MODELING TECHNIQUE,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
L. G. Hulman, and D. K. Erickson.
Tech Paper No 16, The Hydrologic Engineering Center, Corps of Engineers, US Army. 31 p, 6 fig, 6 tab.

Descriptors: *Mathematical models, *Simulation analysis, *Hydrologic properties, *Delaware River, *Streamflow, *Reservoirs, Droughts, Computer programs, Gaging stations, Design.

The record Northeastern United States drought of the 1960's necessitated a detailed reappraisal of water resource systems previously proposed in the affected areas. To facilitate analysis of the effects of the drought, a mathematical modeling technique was developed to allow simulation of the hydrologic properties of the lower Delaware River basin and included eight water resources projects. Modeling requirements considered were: flow records, flow requirements, reservoir operation, and routing requirements. The reservoir system, the general method of analysis and its internal and external constraints were discussed. The final requirements for the model were the determination of the locations of streamflow simulation in the model the 'design' features to be studied, and the statement of the logical methodology required for conversion to instructions necessary for computer processing. Fifteen gaging stations were used as key flow points in the model. Inflows into the reservoirs were computed either by simple drainage area ratios when records were available or by correlation relationships with streamflow data elsewhere in the area where records were not available. (Kriss-Cornell)
W71-00712

WORTH OF STREAMFLOW DATA FOR PROJECT DESIGN - A PILOT STUDY,
Geological Survey, Sacramento, Calif. Hydrologic Systems Lab.; and Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
D. R. Dawdy, H. E. Kubick, L. H. Beard, and E. R. Close.
Tech Paper No 8, The Hydrologic Engineering Center, US Army Corps of Engineers, April, 1968. 9 p, 2 fig, 2 tab, 1 append, 5 ref.

Descriptors: Optimization, *Simulation analysis, *Optimum development plans, *Streamflow, *Design data, *Reservoir design, Multiple-purpose reservoirs, Statistical methods, California.
Identifiers: Historical record.

A procedure for evaluating the worth of streamflow data for project design was described and a simplified example was shown. The present study assessed the effect of sampling error on the worth of data used for ultimate reservoir design. The contemplated methodology as applied in a limited manner to one location for design of a multipurpose reservoir for water supply and low flow regulations, with flood control and minimum pool fixed, was examined. In order to assess the effect of sampling errors in streamflow data on reservoir design, several factors were considered. First, a 'true'optimum design must be known, so that departures from the true design could be measured. Second, the variability of the departures from the true design should depend upon the length of record used for design purposes and statistical properties of the streamflow for the basin to which the design is applied. The Streamflow record for Arroyo Seco near Soledad, California was used. The measured record of flow was used to establish statistics describing the historical record. A 500-year base 'record' was simulated with statistical properties similar to the measured record and was used to determine an optimum design for a simplified multipurpose reservoir for both a 'high' and a 'low' yield at the site. (Kriss-Cornell)
W71-00714

COMMUNITY GOALS-MANAGEMENT OPPORTUNITIES: AN APPROACH TO FLOOD PLAIN MANAGEMENT
Chicago Univ., Ill. Center for Urban Studies.
For primary bibliographic entry see Field 06B.
W71-00736

JOHNSON V DRAKE (LIABILITY FOR FLOOD DAMAGE CAUSED BY BACKWATER).
For primary bibliographic entry see Field 06E.
W71-00756

SOUTHERN RY V NEAL (RAILROAD'S LIABILITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
For primary bibliographic entry see Field 06E.
W71-00760

PURSEL V POLSTER (LOWER RIPARIAN OWNER IS ESTOPPED FROM DENYING THE RIGHT TO DRAW WATER TO SUPPER RIPARIAN OWNER WHO HAD OBTAINED PREVIOUS PERMISSION FROM LOWER OWNER).
For primary bibliographic entry see Field 06E.
W71-00792

NAPORRA V WECKWERTH (ACQUSITION OF PRESCRIPTIVE RIGHT TO DRAIN SURFACE WATER).

226 NW 569-572 (Minn 1929).

Descriptors: *Minnesota, *Prescriptive rights, *Easements, *Surface drainage, Surface runoff, Drainage, Drainage water, Surface waters, Watercourses (Legal), Natural flow, Land tenure, Ditches, Tile drains, Judicial decisions, Legal aspects, Damages.

Plaintiff sought damages for and relief from defendant's obstruction of the flow of surface water from plaintiff's land through a ditch located on defendant's land. The evidence showed that plaintiff's grantor had constructed the ditch on defendant's

grant's land, that plaintiff had on occasion cleaned such ditch, that defendant had seven years earlier put tile in the ditch and that defendant had filled in a hole on his land so that the ditch could not function. The jury found plaintiff had not been damaged, but that he had acquired a prescriptive right to drain water from his land through the ditch. The Supreme Court of Minnesota affirmed. The court stated that the character of the usage of an easement which will ripen into a legal right by prescription is the same as is required to gain title to land by adverse possession. Defendant had contended that his grantor had only given permission to use the ditch for drainage. However, the court held that the evidence was such as to warrant an inference that plaintiff's grantor had entered adversely to defendant's grantor and that defendant's grantor had merely acquiesced in the construction of a drainage ditch through his land. (Duss-Florida)
W71-00808

WATER RELATED LAND USE IN THE WEBER RIVER DRAINAGE AREA,
Utah Water Research Lab., Logan.
Frank W. Haws.
Available from NTIS as PB-191 586, $3.00 in paper copy, $0.95 in microfiche. February 1970. tables, maps. PRWG 40-4.
Identifiers: *Water supplies, *Utah, *Hydrology, Management planning, *Rivers, Drainage, Rural areas, Water supplies, Agriculture, Irrigation systems, Statistical data, Urban areas, Classification, Mountains, Photogrammetry, Lakes, Industries, Plants (Botany), Evaporation, Tables, Maps, Weber River, *Land use, *Regional planning and development.

The Utah Department of Natural Resources, Division of Water Resources (formerly the Utah Water and Power Board) has been charged by the State Legislature with the responsibility of developing a state water plan which would coordinate and give direction to the activities of all state and federal agencies concerned with Utah's water resources. One of the first steps to accomplish this purpose was to divide the state into 10 natural drainage basins and then proceed to inventory and analyze the water resources within each basin. One of the major items to consider in such a study is the amount of water depleted from the basin through the processes of evaporation and transpiration.
W71-00815

STORM DRAINAGE: INVENTORY AND ANALYSIS OF MAJOR EXISTING AND PLANNED FACILITIES. VOLUME V: STORM DRAINAGE.
Valley Regional Planning Agency, Ansonia, Conn.
For primary bibliographic entry see Field 06B.
W71-00820

CHANNEL IMPROVEMENT, FIRE ISLAND INLET, NEW YORK. HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-00822

STORM DRAINAGE FACILITIES, UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 03D.
W71-00827

BEACH PROFILE AS AFFECTED BY VERTICAL WALLS,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 02J.
W71-00833

FLOOD PLAIN INFORMATION, GASTONIA, NORTH CAROLINA.
Corps of Engineers, Charleston, S.C.

Corps of Engineers Flood Plain Report, September 1970. 80 p, 30 fig, 32 plate, 17 tab.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Regional flood, Flood forecasting, Flood control, Streamflow, Flow measurement, Bridges, Historic flood.
Identifiers: *Flood records, Standard project flood, Intermediate regional flood.

Flooding along Crowders, Blackwood, Long, Catawba, Duhart and Avon Creeks in the vicinity of Gastonia, North Carolina is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00846

FLOOD PLAIN INFORMATION, LITTLE, BOLIN, BOOKER AND MORGAN CREEKS, CHAPEL HILL, NORTH CAROLINA.
Corps of Engineers, Wilmington, N.C.

Corps of Engineers Flood Plain Report, May 1970. 52 p, 11 fig, 28 plate, 18 tab.

Descriptors: *Floods, *Flood damage, *North Carolina, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Chapel Hill area (N.C.), Standard project flood, Intermediate regional flood.

Flooding along Morgan, Little, Bolin, and Booker Creeks in the vicinity of Chapel Hill, North Carolina is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-00847

SUSQUEHANNA RIVER BASIN STUDY--A PREVIEW.
Susquehanna River Basin Study Coordinating Committee, Baltimore, Md.

Corps of Engineers, Baltimore District Report, June 1970. 25 p, 21 photo, 6 maps.

Descriptors: *River basin development, *Water resources development, *Land development, Flood control, Planning, Water pollution control, Reclamation, Water quality, Water supply, Reservoirs, Recreation, Abatement, Cost analysis, New York, Pennsylvania, Maryland.
Identifiers: *Susquehanna River basin (NY, Penn, and Md), Streambank stabilization.

This brochure is a brief summary of the Susquehanna River Basin Study made by various Federal and State agencies under the broad guidance of the Study's Coordinating Committee. In response to requests from basin residents, the United States Senate, by a resolution of its Committee on Public Works in 1961, requested that a comprehensive plan be prepared 'for the development of the water and related land resources of the Susquehanna River basin in the States of New York, Pennsylvania, and Maryland.' The study was to be carried out 'in the combined interest of flood control, navigation, water supply, recreation, pollution abatement, and other beneficial water uses.' The House of Representatives, by a similar resolution of its Committee on Public Works, joined with the Senate in its request. The main report will be presented by the Coordinating Committee to the Water Resources Council which will vorward it to the President and the Congress. (Woodard-USGS)
W71-00852

AN UNCONVENTIONAL APPROACH TO FLOOD FREQUENCY ANALYSIS,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 02A.
W71-00861

CHURCHILL V HARRIS (RIGHT TO ENTER LAND TO EXERCISE WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-00871

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
For primary bibliographic entry see Field 05G.
W71-00872

THURSTON V CARTER (BREACH OF CONTRACT TO KEEP TITLE DITCH OPEN).
For primary bibliographic entry see Field 06E.
W71-00873

CHELTENHAM AND ABINGTON SEWERAGE CO V PUBLIC SERVICE COMM'N (DEDICATION OF SEWERAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-00874

WEISBERGER V MAURER (DISCHARGE OF SURFACE WATER ONTO ADJOINING LAND).
For primary bibliographic entry see Field 06E.
W71-00875

SEWER MONITORING AND REMOTE CONTROL-DETROIT.
Detroit Metro Water Services, Mich.
For primary bibliographic entry see Field 05G.
W71-00876

FAIRLAWN MANOR HOMES CO V WILKENS (PRESCRIPTIVE RIGHT TO MAINTAIN DAM).
For primary bibliographic entry see Field 06E.
W71-00891

FLOOD PLAIN INFORMATION, BRUSH CREEK, NORTH HUNTINGDON TOWNSHIP, PENNSYLVANIA.
Corps of Engineers, Pittsburgh, Pa.

Corps of Engineers Flood Plain Report, October 1969. 42 p, 13 fig, 9 plate, 10 tab.

Descriptors: *Floods, *Flood danage, Pennsylvania, Flood plains Regional flood, Flood forecasting, Flood control, Streamflow, Flow measurement, Bridges.
Identifiers: *Flood records, Standard project flood Intermediate regional flood.

Flooding along Brush Creek within the limits o North Huntingdon Township and the Borough o Irwin in Westmoreland County, Pennsylvania i described to aid in solving local flood problems an in planning the best utilization of flood-pron lands. Maps, profiles, cross sections, and te material relating the extent of past flooding t floods which might occur in the future are based o available records of rainfall, runoff, historical floo heights and other technical data. (Woodar USGS)
W71-00892

NNUAL REPORT OF PHREATOPHYTE AC-
VITIES - 1968,
ureau of Reclamation, Denver, Colo. Office of
hief Engineer.
or primary bibliographic entry see Field 03B.
71-00911

ORK V GOLDER (EXISTENCE OF A
RAINAGE EASEMENT OF NECESSITY).
r primary bibliographic entry see Field 06E.
71-00914

ODDARD V BERLIN MILLS CO (LIABILITY
OR FLOODING CAUSED BY BACKWATER
ROM DAM).
r primary bibliographic entry see Field 06E.
71-00938

LEXANDER V WABASH RY (LIABILITY FOR
BSTRUCTION OF SURFACE RUNOFF).
r primary bibliographic entry see Field 06E.
71-00965

HICAGO, ST LOUIS AND NEW ORLEANS RR
ADKINS (LIABILITY FOR OBSTRUCTION
FLOW DUE TO INSUFFICIENT PASSAGE
RAILROAD EMBANKMENT).
r primary bibliographic entry see Field 06E.
71-00966

HESAPEAKE AND O RY V STEPHENS
LOODING CAUSED BY OBSTRUCTION OF
ULVERT UNDER RAILROAD).
r primary bibliographic entry see Field 06E.
71-00967

NKE V ST LOUIS - SAN FRANCISCO RY
IABILITY FOR DISCHARGE OF SURFACE
ATER COLLECTED IN DITCH.
r primary bibliographic entry see Field 06E.
71-00969

HESAPEAKE AND O RY V CLIFTON (LIA-
LITY FOR FLOODING CAUSED BY OB-
TRUCTION OF CULVERT UNDER RAIL-
OAD).
r primary bibliographic entry see Field 06E.
71-00970

AVITT V FOWLER (OWNER MAY CON-
TRUCT DAM AND DITCH ON OWN LAND TO
ECLAIM LAND).
r primary bibliographic entry see Field 06E.
71-00971

DE WATER OIL SALES CORP V SHIMEL-
AN (LIABILITY FOR INTERFERENCE WITH
RAINAGE OF SURFACE WATER).
r primary bibliographic entry see Field 06E.
71-00973

ISSOURI PAC RR V NICHOLS (RAILROAD
AILING TO PROVIDE OPENINGS IN EM-
ANKMENTS LIABLE FOR FLOODING
ANDS).
r primary bibliographic entry see Field 06E.
71-00974

OZY LAKE, INC V NYODA GIRL'S CAMP
NC (RIPARIAN RIGHT TO NATURAL FLOW
F A STREAM).
r primary bibliographic entry see Field 06E.
71-00977

ENDRIX V MCEACHERN (LIABILITY FOR
BSTRUCTION OF NATURAL DRAINAGE OF
PPER LAND).
r primary bibliographic entry see Field 06E.
W71-00980

VIRGINIA HOT SPRINGS CO V HOOVER (LIABILITY FOR DIVERSION OF SPRING WATERS).
For primary bibliographic entry see Field 06E.
W71-00982

DEL BALSO HOLDING CORP V MCKENZIE (OWNERSHIP OF UPLAND AND RIPARIAN RIGHTS).
For primary bibliographic entry see Field 06E.
W71-00983

PLACE V UNION TOWNSHIP (MUNICIPAL LIABILITY FOR ALTERATION OF NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-00985

MOBILE AND O RR V TAYS (LIABILITY FOR ALTERATION OF SURFACE WATER FLOW BY CONSTRUCTION OF RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-00986

SMITH V MCELDERRY (RIPARIAN OWNER'S LIABILITY FOR DIVERSION AND ALTERATION OF NATURAL FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-00989

JAMES V HAMM (LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF DITCHES).
For primary bibliographic entry see Field 06E.
W71-00992

WHITE CONST CO V BROOKS (LIABILITY FOR OBSTRUCTION OF STREAM ALLEGED TO HAVE CAUSED FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-00994

MACLEOD V DAVIS (PRESCRIPTIVE RIGHT TO USE SEWER DRAIN).
For primary bibliographic entry see Field 06E.
W71-00998

HEINE V BANDELIER (DAMAGE FROM IMPROPER DRAINAGE PRACTICE).
For primary bibliographic entry see Field 06E.
W71-00999

WHITLING V TYLER (EQUITABLE RELIEF FROM OBSTRUCTION TO FLOW).
For primary bibliographic entry see Field 06E.
W71-01001

MCKIERNANN V GRIMM (OBSTRUCTION OF NATURAL WATERCOURSE).
For primary bibliographic entry see Field 06E.
W71-01002

SICILIANO V BARBUTO (DISCHARGE OF COLLECTED WATER).
For primary bibliographic entry see Field 06E.
W71-01003

HOLTON V NORTHWESTERN OIL CO (SURFACE WATER DRAINAGE AS NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01006

CHESAPEAKE AND O RY V CALDWELL (LIABILITY FOR DAMAGES RESULTING FROM INSUFFICIENT DRAINAGE THROUGH RAILWAY EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-01008

JOHNSON V CHICAGO B AND Q RR (WAIVER OF RIGHT TO DAMAGES CAUSED BY OBSTRUCTION TO FLOW OF NATURAL DRAIN).
For primary bibliographic entry see Field 06E.
W71-01012

NORDLUM V GREAT NORTHERN RY (ALTERATION OF NATURAL COURSE OF DRAINAGE WATER BY RAILROAD BED CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-01014

HICKEL V CHICAGO R I AND P RY (ALTERATION OF NATURAL COURSE OF DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01015

DALY V STATE (EXTRAORDINARY RAINFALL IS NO DEFENSE TO NEGLIGENCE IN MAINTAINING A CANAL).
For primary bibliographic entry see Field 06E.
W71-01018

COUCH V CLINCHFIELD COAL CORP (COAL COMPANY'S LIABILITY FOR DIVERTING FLOW OF PERCOLATING WATER).
For primary bibliographic entry see Field 06E.
W71-01022

MCNABB V HOUSER (DIVERSION OF WATER FROM A NON-NAVIGABLE STREAM).
For primary bibliographic entry see Field 06E.
W71-01024

DRUCE V BLANCHARD (NATURAL FLOW OF DRAINAGE CREATES EASEMENT).
For primary bibliographic entry see Field 06E.
W71-01030

MADDOCK V CITY OF SPRINGFIELD (FLOODING BY SURFACE WATER DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01032

KUNKLE V BOROUGH OF FORD CITY (OBSTRUCTION TO FLOW OF SWAMP DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01040

HENDRIX V ROBERTS MARBLE CO (RIPARIAN RIGHTS LIMITED TO RIPARIAN LAND).
For primary bibliographic entry see Field 06E.
W71-01045

FACKLER V CINCINNATI NO AND TP CO (PROOF OF DAMAGES REQUIRED IN ORDER TO ENFORCE COVENANT NOT TO OBSTRUCT NATURAL STREAMFLOW).
For primary bibliographic entry see Field 06E.
W71-01048

SQUAW ISLAND FREIGHT TERMINAL CO V UNITED STATES (DAMAGES TO ISLAND FROM FAILURE TO MAINTAIN DIKE).
For primary bibliographic entry see Field 06E.
W71-01049

NORTHWEST RR V UNITED STATES (STRUCTURES ERECTED IN BED OF NAVIGABLE STREAM SUBJECT TO DESTRUCTION WITHOUT REMEDY BY UNITED STATES IN AID OF NAVIGATION.
For primary bibliographic entry see Field 06E.
W71-01051

TRANSIENT FLOW BETWEEN PARALLEL DRAINS,
California Univ., Los Angeles; and San Jose State Coll., Calif.
William Wen-Gong Yeh, and Rameshwar Singh.
Journal of Hydrology, Vol 11, No 3, p 301-312, September 1970. 12 p, 12 fig, 1 tab, 7 ref.

Descriptors: *Subsurface drainage, *Unsteady flow, *Groundwater movement, *Mathematical studies, *Computer programs, Linear programming, Soil water movement, Drainage systems, Hydraulic conductivity, Specific yield, Dupuit-Forchheimer theory, Permeability, Drawdown.
Identifiers: Transient groundwater flow.

The problem of transient-flow subsurface drainage between parallel drains has been solved by the method of weighted-residuals. The assumption of an initial profile is removed in this method. The governing nonlinear partial differential equation is reduced to ordinary differential equations which are easily solvable on the computer. The solution is presented in two nondimensional graphical forms for easy field application. (Knapp-USGS)
W71-01063

RAU V URBAN (LIABILITY FOR PREDECESSOR'S IN TITLE ACTS).
For primary bibliographic entry see Field 06E.
W71-01075

O'NEAL V ROLLINSON (RIPARIAN RIGHTS EXTEND PERPENDICULAR TO LAND).
For primary bibliographic entry see Field 06E.
W71-01078

FITZSIMMONS V CASSITY (OWNER OF LAND TAKEN BY RIVER RECEIVES TITLE TO OLD RIVER BED).
For primary bibliographic entry see Field 06E.
W71-01079

FITZGERALD V FORTIER (LIABILITY FOR OBSTRUCTION OF WATERCOURSES).
For primary bibliographic entry see Field 02E.
W71-01082

FOSTER V MALSBURY (INJUNCTIVE RELIEF FOR OBSTRUCTION OF WATERCOURSE).
For primary bibliographic entry see Field 06E.
W71-01083

SCHWARTZ V WAPELLO COUNTY (PUBLIC RIGHTS TO NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01084

FLOOD PLAIN INFORMATION OF LICKING RIVER, CAMPBELL AND KENTON COUNTIES, KENTUCKY.
Corps of Engineers, Louisville, Ky.

Corps of Engineers Flood Plain Report, December 1968. 34 p, 7 fig, 11 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Kentucky, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Flood records, *Licking River (Campbell and Kenton Counties, Ky), Standard project flood, Intermediate regional flood.

Flooding along the Licking River in Campbell and Kenton Counties, Kentucky is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-01095

FLOOD PLAIN INFORMATION STUDY, PIGEON CREEK, VANDERBURGH COUNTY, INDIANA - MAIN REPORT.
Corps of Engineers, Louisville, Ky.

Corps of Engineers Flood Plain Report, May 1967. 36 p, 9 fig, 4 plate, 5 tab, 13 ref.

Descriptors: *Floods, *Flood damage, *Indiana, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Flood records, Flood frequencies, Standard project flood, Intermediate regional flood.

Flooding along Pigeon Creek in Vanderburgh County, Indiana is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-01096

4B. Groundwater Management

LAND SUBSIDENCE RELATED TO DECLINE OF ARTESIAN HEAD AT BATON ROUGE, LOWER MISSISSIPPI VALLEY, U. S. A.,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W71-00563

NEED FOR SALINE GROUNDWATER DATA TO ADVANCE DESALTING TECHNOLOGY,
Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03A.
W71-00570

ACQUISITION AND MACHINE PROCESSING OF SALINE WATER DATA FROM SOUTHEASTERN NEW MEXICO AND WESTERN TEXAS,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 07C.
W71-00572

DEEP WELL DISPOSAL OF WASTE WATERS IN SALINE AQUIFERS OF SOUTH FLORIDA,
Black, Crow and Eidsness, Inc., Gainesville, Fla.; and Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05E.
W71-00573

PLAYA WATER QUALITY CHANGES WITH TIME AND EFFECTS ON CLARIFICATION,
Agricultural Research Service, Bushland, Tex. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02K.
W71-00578

FLUID TRAVEL TIME BETWEEN A RECHARGING AND DISCHARGING WELL PAIR IN AN AQUIFER HAVING A UNIFORM REGIONAL FLOW FIELD,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 02F.
W71-00581

DOES ARTIFICIAL GROUNDWATER RECHARGE CONTAMINATE OUR GROUND WATERS,
Texas Tech Univ., Lubbock. Dept. of Agricultura Engineering; Purdue Univ., Lafayette, Ind. Dept. o Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W71-00628

THE DESIGN OF AN EXPERIMENTAL ARTIFICIAL RECHARGE WELL AT TUCSON ARIZONA,
Arizona Water Resources Research Center, Tuc son.
L. G. Wilson, M. M. Fogel, K. J. DeCook, and P. S Osborne.
Annals of Arid Zone, Vol 8, No 2, p 267-274, Se tember 1969. 1 fig, 8 ref. OSW Contract 14-0 0001-630.

Descriptors: *Artificial recharge, *Recharge well *Groundwater recharge, *Water conservatio *Hydrogeology, Sedimentary basins (Geologica Alluvium, Ephemeral streams, Effluents, On-si tests, Arid lands, Arizona, Wells, Pumpin Withdrawal, Design, Injection wells, Equipme Subsurface flow.
Identifiers: Tucson (Arizona).

Tucson, Arizona, obtains its entire water supply pumping groundwater. Recharge occurs during fluent seepage in ephemeral rivers, but it is laggi behind withdrawal and water levels are dropping a rate of about 1 meter per year. Artificial w recharge appears to be the best regional water co servation mechanism. In designing an artific recharge well, it is important to investigate subs face materials at the proposed site. Driller's lo were examined, a water supply well and 3 obser tion wells were drilled, geophysical explorati techniques were utilized and subsurface fl characteristics determined. Since the materials the vadose zone were found to be highly perm ble, a dual recharge well was constructed recharge of the unsaturated region as well as phreatic zone. The design and operation of the w are described in detail. Injected water was indus al effluent from a nearby power plant. Recha tests showed injection rates ranging over 23- cubic meters per hour. Such wells may be effect tools for water conservation in the Tucson Ba (Casey-Arizona)
W71-00691

DETERMINISTIC LINEAR HYDROLOG SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-00728

USE OF ANALOG COMPUTER IN GROU WATER HYDROLOGY,
Minnesota Univ., Minneapolis. Water Resou Research Center.
William C. Walton.
Progress of Hydrology, Vol I, pp 265-289, 1969. 25 p, 8 fig, 11 ref.

Descriptors: *Analog Computers, *Aqui Hydrology, Groundwater, Analytical techniq Missouri River.

A complete description of the Analog comp generally consisting of an analog made and ex tion-response apparatus, i.e., a waveform ge tor, pulse generator, and oscilloscope, presented. The analog model described was a r lar array of resistors and capacitors, and w caled down version of the aquifer. An analogy drawn between electrical systems and aq systems. The excitation-response apparatus w lustrated. An investigation made by Saskatchewan Research Council from 196 1966 to determine the nature and extent of and gravel aquifers in the buried Missouri Valley system in the vicinity of Est

skatchewan, Canada and to estimate the potential yield of the aquifers with selected schemes of velopment was given as a case history of the use an analog computer. The investigation included llection and analysis of water-level data to define e piezometric surfaces of the aquifers and asciated deposits and the data on the chemical aracter of the groundwaters, an extensive textle drilling program, controlled aquifer and well oduction tests, and an analog computer study. e reach of the buried Missouri River Valley tem west, east and north of Estevan was conered. (Kriss-Cornell)
71-00732

ROUNDWATER UTILIZATION: STUDY OF ETHODS, WITH ENGINEERING ANALYSIS,
dro Research Science, Sunnyvale, Calif.
exander B. Rudavsky.
ailable from the NTIS as AD-858 430, $3.00 in per copy, $0.95 in microfiche. September 13, 59. 42 p.
ntifiers: *Water, Underground, *Water supes, *Drilling, *Water wells, *Bibliographies, rilling machines, Reviews, Test methods, Indusl production, Army operations, Military eneering, Catalogs, Groundwater, Potable water.

e objective of the report is to summarize known ll-construction techniques for obtaining groundter during military field operations. A considera number of references on drilling methods and ipment exist in multi-language literature. The rature study shows considerable completed earch for developing bottom hole drilling thods. There has been much study on the contional application of turbodrills in Russia. Conerable efforts have also been spent to improve sent drilling tools and systems in order to reduce lling costs. The review of manufacturer's alogs, leaflets, descriptive literature, and other nted matter on off-shelf items for the well lling industry indicates very few radical changes drilling concepts but a trend of the industry to prove the drilling techniques and well construcn.
71-00783

DROLOGY OF PROJECT GASBUGGY SITE, O ARRIBA COUNTY, NEW MEXICO,
ological Survey, Denver, Colo.
ry W. Mercer.
ailable from NTIS as PNE-1013, $3.00 in paper py, $0.95 in microfiche. Atomic Energy Comsion Project Gasbuggy Peaceful Nuclear Explons Report PNE-1013 (TID-4500), March 6, 70. 45 p, 12 fig, 4 tab, 4 ref.

scriptors: Hydrology, *Nuclear explosions, *Unground, *New Mexico, Groundwater, Aquifers, nsmissivity, Aquifer characteristics, Water ls, Discharge measurement, Water quality, drologic data, Geology, Sandstones, Draindown, uations, Chemical analysis, Pollutants.
ntifiers: *Ojo Alamo Sandstone, Exploratory es.

e Project Gasbuggy nuclear experiment of 26 otons design yield was detonated at 4,240 feet ow ground surface at the Gasbuggy site in Rio riba County, New Mexico on December 10, 57. The experiment was designed to increase the meability of a low-yield natural gas formation. e Ojo Alamo Sandstone reportedly was the only uifer within probable range of fracturing at the . Thus, hydrologic testing in the exploratory es was in that sandstone between approximate oths of 3,475 and 3,650 feet. Data indicated that he nuclear detonation fractured the Ojo Alamo dstone, water from this sandstone would fill the mney or detonation chamber at an estimated e of less than half a foot per day. The low transsivity of the sandstone aquifer would hinder the nsport of radioactive contaminants in water in aquifer, even if momentary overpressure in the losion cavity caused contaminants to reach the o Alamo Sandstone. Observation of water levels in wells and measurements of yields of springs prehot, at shot time, and postshot indicate that the detonation did not significantly or permanently disturb nearly water wells or springs. (Woodard-USGS)
W71-00810

OPTIMIZING CONJUNCTIVE USE OF GROUNDWATER AND SURFACE WATER,
Utah Water Research Lab., Logan.
James H. Milligan.
Available from NTIS as PB-192 712, $3.00 in paper copy, $0.95 in microfiche. June 1970. 160 p. PRWG 42-4T.
Identifiers: *Management planning, Hydrology, *Water supplies, *Utah, Mathematical models, Programming (Computers), Stochastic processes, Linear programming, Rivers, Design, Probability, Optimization, Storage, Costs, Theses, *Groundwater, *Water management, Computerized simulation, Surface water runoff.

The determination of optimal allocations of surface water and groundwater resources that will accomplish the objective of economic efficiency as measured by maximizing net benefits is the basic objective of the several models developed and described in this report. The mathematical procedure used for optimizing the water resource allocations in this fashion makes use of several algorithms of linear programming as available on a Univac 1108 digital computer. Each of the solutions derived from the models presented is analyzed in order to evaluate the optimization procedure. Models are formulated for one hypothetical hydrologic unit or basin and for two real river basins. The real river basins were used to test the viability of the modeling procedure and to evolve a practical methodology.
W71-00816

FRESHWATER BUBBLES: A POSSIBILITY FOR USING SALINE AQUIFERS TO STORE WATER,
Geological Survey, Denver, Colo.
E. A. Moulder.
Water Resources Research, Vol 6, No 5, p 1528-1531, October 1970. 4 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Water storage, *Reviews, *Underground storage, *Saline water systems, *Water resources development, Aquifers, Saline water, Groundwater movement, Mixing, Dispersion, Diffusion, Flow, Water management (Applied), Conjunctive use.
Identifiers: Saline water resources, Saline aquifers.

Saline aquifers appear to have promising storage capabilities for freshwater supplies. Such aquifers would be a practical alternative to surface water reservoirs in areas where natural reservoir sites are scarce or where evaporation might consume a substantial part of the water stored. A single experiment in Virginia more than 20 years ago shows that a substantial amount of freshwater injected into the saline aquifer can be recovered. Environmental factors that affect water recovery are dispersion and mixing at the fresh-saline water interface, reshaping of the interface because of density differences of the fluids, and groundwater movement in the saline aquifer system. Mathematical approaches to estimating these factors are reviewed. Feasibility studies of storage facilities should include evaluation of at least these three factors. (Knapp-USGS)
W71-00836

DESALTING SALINE GROUNDWATER FOR IRRIGATION: A CASE STUDY, BUCKEYE, ARIZONA,
Bureau of Reclamation, Denver, Colo.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03A.
W71-00837

FLUID MODEL STUDIES OF THE STORAGE OF FRESHWATER IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
Oscar R. Kimbler.
Water Resources Research, Vol 6, No 5, p 1522-1527, October 1970. 6 p, 4 fig, 4 ref.

Descriptors: *Hydraulic models, *Underground storage, *Artificial recharge, *Saline water systems, Injection wells, Model studies, Mixing, Withdrawal, Dispersion, Diffusion, Conjunctive use, Water resources development, Aquifers.
Identifiers: Saline aquifers, Saline water resources.

Flow studies in artificial sandstone models were used to test and validate a computational technique for predicting the recovery of freshwater stored in saline aquifers. These studies indicate the physical and operational conditions under which such storage should be technically feasible, and show that gravitational effects are usually a much more important cause of poor freshwater recovery than is dispersion. (Knapp-USGS)
W71-00838

STORAGE OF NATURAL GAS IN SALINE AQUIFERS,
Michigan Univ., Ann Arbor.
Donald L. Katz, and M. Rasin Tek.
Water Resources Research, Vol 6, No 5, p 1515-1521, October 1970. 7 p, 9 fig, 2 tab, 8 ref.

Descriptors: *Underground storage, *Aquifers, *Reviews, *Saline water systems, *Natural gas, Water resources development, Injection wells, Oil fields, Oil reservoirs, Injection.
Identifiers: Saline aquifers.

Value, extent, and engineering description of underground storage of natural gas in saline aquifers are reviewed. Problems associated with evaluation of aquifer storage prospects, geologic and geochemical requirements have been discussed along with topics related to operating pressures, gas retention, and pump tests. (Knapp-USGS)
W71-00839

REDUCING LAND SUBSIDENCE IN THE WILMINGTON OIL FIELD BY USE OF SALINE WATERS,
Long Beach Dept. of Oil Properties, Calif.
Robert L. Pierce.
Water Resources Research, Vol 6, No 5, p 1505-1514, October 1970. 10 p, 9 fig.

Descriptors: *Injection wells, *Oil fields, *Land subsidence, *California, *Withdrawal, Secondary recovery (Oil), Flooding, Oil wastes, Water treatment, Brine disposal.
Identifiers: Subsidence control, Long Beach (Cal).

The subsidence at Long Beach encompassed an area of 22 square miles; sinkage ranges from 2 feet to 30 feet. The subsidence is attributed to pressure reduction due to oil production from the Wilmington oil field. Injection of saline water stopped the Long Beach harbor area subsidence and has developed a technology for an economic waterflood project. Through December 1968, 2.1 billion barrels of saline water have been injected into the Wilmington oil field. The current injection rate of the field is 1.1 million barrels per day. The methods being used to clean the oil field's produced brine include: (1) filtration, (2) re-cycling through the shallow source water beds, and (3) blending with fresh or other saline waters. (Knapp-USGS)
W71-00840

WATER POLLUTION CONTROL CREATES DEMAND FOR GROUNDWATER HYDROLOGISTS,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 05G.
W71-00848

REPORT ON GEOPHYSICAL AND TELEVISION EXPLORATIONS IN CITY OF JACKSONVILLE WATER WELLS,
Geological Survey, Tallahassee, Fla.
G. W. Leve.
Florida Bureau of Geology Information Circular No 64, 1970. 15 p, 9 fig, 1 tab.

Descriptors: *Water wells, *Groundwater, *Telemetry, *Borehole geophysics, *Surveys, *Water supply, Aquifers, Petrography, Gamma rays, Geomorphology, Borehole cameras, Subsurface investigations, Electrical resistivity, Electrical properties.
Identifiers: *Television surveys (Water wells), Aquifer evaluation.

During November 1968, eight water production wells for the city of Jacksonville, Fla. were examined for physical condition and further information on the hydrologic properties of the aquifer. The data were collected from electric logs, gamma logs, caliper logs, current meter traverses, and television traverses, and are presented as part of a comprehensive investigation to fully appraise the water resources in the Jacksonville area. (Woodard-USGS)
W71-00849

COMPREHENSIVE PLANNING STUDY OF THE GRAND RIVER BASIN, MICHIGAN--APPENDIX E.
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02F.
W71-00851

PRELIMINARY EVALUATION OF AVAILABILITY OF POTABLE WATER ON ELLIOTT KEY, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 03B.
W71-00881

GEOLOGY AND GROUNDWATER RESOURCES OF THE ASHEVILLE AREA, NORTH CAROLINA,
Geological Survey, Raleigh, N.C.
For primary bibliographic entry see Field 02F.
W71-00903

MINING WATER IN IRAN,
Utah State Univ., Logan. Dept. of Agricultural Economics.
Allen LeBaron, and Malek Mohtadi.
Utah Science, Utah Agricultural Experiment Station, Utah State University, September 1968, Vol 29, No 3, p 88-89, 92, 2 fig.

Descriptors: *Groundwater supply, *Irrigation wells, *Arid lands, *Groundwater mining, *Water harvesting, Social aspects, Shafts (Excavations), Tunnel construction, Cost comparisons, Irrigation systems, Water reuse, Canals, Wells, Runoff.
Identifiers: *Ghanats, *Moghanis, *Horizontal wells, *Underground infiltration tunnels, Well development, Iran.

Ghanats (underground infiltration tunnels or horizontal wells) are an important water source in Southwest Asia and North Africa. From 1/3 to 3/4 of all irrigation in Iran is supplied by ghanats. They capture rainwater which runs quickly off mountains and seeps into alluvial fans. A mother well is evcavated and the water flows to the surface by a gently sloping tunnel, then travels by open canal. The underground ghanat is marked by shafts used to lift earth during construction and to facilitate maintenance. The average ghanat is 150 feet deep and over 2 miles long. A long ghanat may have several hundred shafts. Seepage from irrigated fields is sometimes recollected and passed on to another ghanat. Water ownership is the deciding factor in land settlement. For aesthetic, mechanical and supply reasons, mills and residences are located near ghanats. Costs of ghanats may be favorable compared to drilled wells utilizing petroleum. Workers called 'Moghanis' specialize in ghanat excavation and maintenance--a family occupation passed through generations. Although there are hazards of falling stones, collapsing roofs, asphyxiation and drowning, there are from 20,000 to 40,000 Moghanis. A typical cross-section and areal route of an Iranian ghanat are shown in the article. (Popkin-Arizona)
W71-00958

RECHARGING THE OGALLALA FORMATION USING SHALLOW HOLES,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering.
Marvin Dvoracek, and Sam H. Peterson.
Texas Tech Univ Contribution No 78, Paper Presented at Ogallala Aquifer Symposium, Texas Tech Univ, Lubbock, April 30-May 1, 1970. 18 p, 7 fig, 1 tab, 15 ref. OWRR Project B-041-Tex.

Descriptors: *Artificial recharge, *Injection wells, *Unsaturated flow, Water levels, Infiltration, Water table, Water level fluctuations, Percolation, Permeability, Caliche, Alluvium.
Identifiers: Ogallala aquifer, Shallow recharge wells.

Natural groundwater recharge cannot sustain the Southern High Plains portion of the Ogallala Formation. Nearly all the water used in this region is derived from the Ogallala Formation. The southern part of the Ogallala is hydrologically isolated from all outside areas; natural recharge to this portion of the aquifer originates only form precipitation falling on the aquifer. The region has only limited and erratic rainfall, poorly established drainage, and very few lakes or reservoirs; therefore, it offers little opportunity for natural recharge. The volume of water withdrawn, as shown by the water level decline, is many times greater than the estimated natural recharge of about 1 inch per year. In tests, more than 15 acre-feet of runoff water was recharged in shallow holes completed above the water table. Increases in rate of recharge were observed during the tests. A condition of soil piping is probably responsible for the increasing rates and loss of material from cavities near the recharge wells. (Knapp-USGS)
W71-01058

TAUNTON RIVER BASIN-MASSACHUSETTS BASIC-DATA REPORT NO. 12, GROUNDWATER SERIES,
Geological Survey, Boston, Mass.
John R. Williams, and Richard E. Willey.
US Geological Survey Open-file report, 1970. 102 p, 1 fig, 1 plate, 5 tab, 4 ref.

Descriptors: *Hydrologic data, *Water wells, Massachusetts, *Groundwater, *Water levels, Water quality, Aquifers, Water resources, Water resources development, Water yield, Observation wells, Sampling, Hydrogeology, Data collections.
Identifiers: Taunton basin (Mass).

This report presents in tabular form selected records of wells, test wells, and borings collected during a study of the Taunton basin from 1966 to 1968 in cooperation with the Massachusetts Water Resources Commission, and during earlier studies. The public and local, state, and federal agencies may use this basic groundwater information that may aid in planning water-resources development. Data on 2,059 selected wells, test wells, and borings, including United States Geological Survey auger borings, Massachusetts Department of Public Works bridge and roadway borings, and miscellaneous foundation borings are tabulated. Chemical and partial chemical analyses are given of the water from 137 wells. Water level measurements in 11 observation wells are presented as hydrographs. (Knapp-USGS)
W71-01089

MULTIVARIATE ANALYSIS IN GROUNDWATER HYDROLOGY -- THEORY,
California State Coll., Long Beach. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-01098

4C. Effects on Water of Man's Non-Water Activities

MODELING THE EFFECT OF LAND USE MODIFICATIONS ON RUNOFF,
Agricultural Research Service, Brookings, S. Dak. and Water Resources Board, Reading (England).
C. A. Onstad, and D. G. Jamieson.
Water Resources Research, Vol 6, No 5, p 1287-1295, October 1970. 9 p, 9 fig, 8 tab, 6 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Precipitation excess, *Parametric hydrology, Simulation analysis, Routing, Synthetic hydrology, Runoff forecasting, Land use, Land management, Hydrograph analysis, Optimization, Flood control, Soil conservation.
Identifiers: *Runoff management.

The natural apportionment of rainfall excess to surface and subsurface flow can mean the difference between large flow rates for a short time or more manageable flow rates over a longer time. By using available soil storage, peak flood flows can be reduced without necessarily reducing the total volume of runoff. A model was made to simulate this phenomenon. The land phase of the hydrologic system was simulated by a series of interconnected nonlinear reservoirs and the channel phase by a single linear reservoir. By manipulation of parameters which mathematically represent physical measurements, the watershed response to the addition of conservation practices, such as terracing, may be predicted. (Knapp-USGS)
W71-00589

THE MEASUREMENT OF THE EFFECTS OF BUILDING CONSTRUCTION ON DRAINAGE BASIN DYNAMICS,
Exeter Univ. (England).
D. E. Walling, and K. J. Gregory.
Journal of Hydrology, Vol 11, No 2, p 129-144, August 1970. 16 p, 8 fig, 21 ref.

Descriptors: *Construction, *Urbanization, *Sediment yield, *Storm runoff, Rainfall-runoff relationships, Hydrograph analysis, Erosion, Soil erosion, Regression analysis, Peak discharge, Stage-discharge relations.
Identifiers: Urban hydrology.

The magnitude of the impact of building activity upon suspended sediment concentrations may be assessed by comparing samples obtained simultaneously at different points within one catchment or by comparing samples derived from two adjacent small watersheds, one of which serves as a control. In each case the suspended sediment concentrations are between 2 and 10 times, and occasionally up to 100 times, greater than the concentrations obtained from undisturbed conditions. The form of the relationships obtained demonstrates the importance of variable source areas within the catchments. To assess the yields over time, stream flow and sediment records are required. A small catchment has been instrumented for this purpose on the margin of Exeter, Devon, England. The catchment was calibrated for a period of 17 months prior to building activity by deriving multiple regression equations relating peak flow, runoff amount and runoff percentage to precipitation characteristics at different times of the year, evaluating unit hydrographs, by establishing suspended sediment rating curves, and by using adjacent catchments as controls. (Knapp-USGS)
W71-00592

ORM WATER POLLUTION FROM URBAN
ND ACTIVITY, DEVELOPMENT OF
ALYTICAL PROCEDURES FOR PREDICT-
G STORM WATER POLLUTION FROM
BAN AREAS BY USE OF SELECTIVELY
FINED URBAN CHARACTERISTICS.
co Economic Systems Corp., Washington, D.C.
r primary bibliographic entry see Field 05A.
1-00619

ITROLE RESIDUES AND RATE OF DIS-
ATION IN IRRIGATION WATER,
ricultural Research Service, Denver, Colo.
ps Research Div.; and Agricultural Research
vice, Prosser, Wash. Crops Research Div.
primary bibliographic entry see Field 03F.
1-00698

UTHERN RY V NEAL (RAILROAD'S LIA-
ITY FOR FLOODING CAUSED BY IN-
EQUATE CULVERT).
primary bibliographic entry see Field 06E.
1-00760

TIAL ENVIRONMENTAL STUDY.
e and Niagara Counties Regional Planning
rd, Grand Island, N.Y.
primary bibliographic entry see Field 06G.
1-00785

NING WATER IN IRAN,
h State Univ., Logan. Dept. of Agricultural
nomics.
primary bibliographic entry see Field 04B.
1-00958

EXANDER V WABASH RY (LIABILITY FOR
STRUCTION OF SURFACE RUNOFF).
primary bibliographic entry see Field 06E.
1-00965

ICAGO, ST LOUIS AND NEW ORLEANS RR
ADKINS (LIABILITY FOR OBSTRUCTION
FLOW DUE TO INSUFFICIENT PASSAGE
RAILROAD EMBANKMENT).
primary bibliographic entry see Field 06E.
1-00966

ESAPEAKE AND O RY V STEPHENS
OODING CAUSED BY OBSTRUCTION OF
LVERT UNDER RAILROAD).
primary bibliographic entry see Field 06E.
1-00967

NKE V ST LOUIS - SAN FRANCISCO RY
ABILITY FOR DISCHARGE OF SURFACE
TER COLLECTED IN DITCH.
primary bibliographic entry see Field 06E.
1-00969

ESAPEAKE AND O RY V CLIFTON (LIA-
ITY FOR FLOODING CAUSED BY OB-
RUCTION OF CULVERT UNDER RAIL-
AD).
primary bibliographic entry see Field 06E.
1-00970

SSOURI PAC RR V NICHOLS (RAILROAD
ILING TO PROVIDE OPENINGS IN EM-
NKMENTS LIABLE FOR FLOODING
NDS).
primary bibliographic entry see Field 06E.
1-00974

TESVILLE SAND AND GRAVEL CO V
LAUGHLIN (OWNERSHIP OF SANDBAR IN
VIGABLE STREAM).
primary bibliographic entry see Field 06E.
1-00976

EASTON V STATE (AMOUNT OF COMPENSATION FOR TAKING OF LAND AND POLLUTING A STREAM).
For primary bibliographic entry see Field 06E.
W71-01073

LEITCH V SANITARY DISTRICT (RIPARIAN RIGHTS AND OBSTRUCTIONS TO NAVIGATION).
For primary bibliographic entry see Field 06E.
W71-01076

4D. Watershed Protection

A GEOMORPHIC APPROACH TO EROSION CONTROL IN SEMIARID REGIONS,
Colorado State Univ., Fort Collins. Dept. of Geology.
S. A. Schumm.
American Society of Agricultural Engineers Transactions, Vol 12, No 1, p 60-68, January-February, 1969. 9 p, 21 fig, 3 tab, 34 ref.

Descriptors: *Erosion control, *Semiarid climates, *Geomorphology, Sediment yield, Streamflow, Drainage systems, Hydrologic properties, Vegetation, Precipitation (Atmospheric), Topography, Slopes, Runoff, Geology, Channel morphology, Sands, Channel erosion, Drainage patterns (Geologic), Rainfall-runoff relationships.

Erosional and depositional phenomena from a geomorphic perspective are evaluated from about 10 years of research concerning semiarid landforms. Emphasis on the processes of landscape modification and a quantitative description of landforms has provided information on the origin of certain features, and a means of delineating critical areas of the landscape where conservation techniques should be most effective. Related pictures, tables, and graphs are included. (Woodard-USGS)
W71-00605

EROSION-CONTROL PROBLEMS AND PRACTICES ON NATIONAL FOREST LANDS,
Forest Service (USDA), Logan, Utah. Div. of Soil and Water Management.
S. L. Cuskelly.
American Society of Agricultural Engineers Transactions, Vol 12, No 1, p 69-70, 85, January-February, 1969. 3 p.

Descriptors: *Erosion control, *National forests, Vegetation, Watershed management, Runoff, Sediment yield, Precipitation (Atmospheric), Forests, Reclamation, Soil stabilization.
Identifiers: Artificial seeding, Restoration, National Forests.

This paper reviews some of the procedures and equipment used in the restoration of national forest watersheds since the days of the civilian conservation corps in the 1930's including contour trenching, contour furrowing, and streambank and gully stabilization. Problems that still confront us are emphasized such as in the intermountain region national forests there are about 1,380,000 acres of rangeland and 860,000 acres of critical watershed area in need of rehabilitation. There are 5,900 miles of road and 3,240 miles of streambank needing stabilization. As watershed values increase and demands for restoration (and for that matter, all uses and activities) become even greater, these problems must be solved. (Woodard-USGS)
W71-00606

EROSION PROBLEMS AND CONTROL PRACTICES ON FEDERAL DOMAIN LANDS,
Bureau of Land Management, Logan, Utah.
Myrvin E. Noble.
American Society of Agricultural Engineers Transactions, Vol 12, No 1, p 71-74, January-February, 1969. 4 p, 2 fig, 2 tab.

Descriptors: *Erosion control, *Federal Government, Natural resources, Runoff, Sediment yield, Precipitation (Atmospheric), Streamflow, Vegetation, Conservation.
Identifiers: Federal domain lands, Bureau of Land Management, Western states.

Some of the most severe soil loss problems in the United States occur on the 174 million acres of leftover public domain remnants located mostly in 10 western states. These are lands administered by the Bureau of Land Management (BLM). In addition, the bureau has jurisdiction over 278,000,000 acres in Alaska; but it is this residue in the western conterminous states, after decades of government-allowed land entries, grants, reservations, and withdrawals, that presents a picture of critical depletion. This report reviews the problems and objectives concerning the conservation of these lands. Related information is presented in tables and maps. (Woodard-USGS)
W71-00607

FOREST SERVICE RESEARCH IN EROSION CONTROL,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Otis L. Copeland.
American Society of Agricultural Engineers Transactions, Vol 12, No 1, p 75-79, January-February, 1969. 5 p, 8 fig, 1 tab, 21 ref.

Descriptors: *Erosion control, *Federal government, *Watershed management, Precipitation (Atmospheric), Runoff, Streamflow, Sediment yield, Floods, Soil stabilization, Vegetation, Forests, Range management.
Identifiers: Forest service research, National Forests.

Functions of the U.S. Forest Service relating to factors that affect erosion processes, erosion-prevention actions, and erosion-control practices in watershed management research are described. Specific projects directly studying soil erosion processes and control are as follows: (1) Intermountain Station - Streamflow regulation and sediment reduction in northern Rocky Mountain forests, Preventing of controlling accelerated erosion of unstable forest soils, and Watershed protection requirements and rehabilitation measures to reduce flood runoff, erosion, and sediment from deteriorated rangelands and grazed forested areas; (2) Pacific Northwest Station - Soil stabilization and runoff regulation in conifer watersheds in Washington and Oregon, Water-yield improvement and erosion control - mid-Columbia River basin forests, and Erosion and sediment reduction, Alaska coastal forests; (3) Pacific Southwest Station - Hydrologic analysis methods, Flood and sediment reduction in the coniferous timber zone of California, and Flood and sediment reduction in steep, unstable brushlands of the Southwest; and (4) Rocky Mountain Station - Water-yield improvement and erosion control for montane and subalpine forests and rangelands, Improvement of water yields and soil stabilization: Big Horn, Powder River, and the North Platte River basins, Watersheds rehabilitation to control erosion and sedimentation in the Southwest, and Improvement of water yields and soil stabilization in the Black Hills. As of April 30, 1967, forty-two active studies relating to soil erosion were being conducted by these 13 projects. (Woodard-USGS)
W71-00608

STUDY OF EROSION IN ROADSIDE DRAINAGE CHANNELS IN NORTH CAROLINA,
North Carolina State Univ., Raleigh. School of Engineering.
Michael Amein, and H. L. Chu.
Available from NTIS as PB-191 398, $3.00 in paper copy, $0.95 in microfiche. September 1969, 63 p. Appendix to Project ERD-110-68-4.
Identifiers: *Roads, Drainage, *Erosion, Roads, Site selection, Sampling, Soil mechanics, Stability,

Statistical data, North Carolina, Ditches, *Drainage channels.

As part of an effort to establish criteria for the design of roadside drainage channels, a survey of many sites was made along the North Carolina highways. The survey consisted of measurement of the size of the contributing surface areas to the drainage, the measurement of the channel slope, the measurement of the channel cross section, identification of the surface cover, identification of points of incipient and severe erosion, identification of the extent of erosion and finally, testing of the soil samples. The soil test included sieve analysis and determination of the Atterberg limits. In addition, the location of each test site was marked on an area map. The results of this survey have been used to develop guidelines for the design of roadside channels. From these guidelines, the designer can hopefully predict whether a particular roadside channel (earth or grass) will be resistant to erosion and remain stable or whether there is a greater probability for erosion. In the latter case the use of a more resistant surface treatment such as paving would be recommended. This Appendix contains data and information which were used in the study on roadside drainage channels.
W71-00806

RESPONSE UNITS FOR EVALUATING THE HYDROLOGIC PERFORMANCE OF RANGELAND WATERSHEDS,
Agricultural Research Service, Boise, Idaho. Northwest Watershed Research Center.
For primary bibliographic entry see Field 02G.
W71-00866

ORGANIZING FOR SOIL EROSION AND SEDIMENT CONTROL IN OUR NATIONS URBAN AREAS,
National Association of Counties Research Foundation, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-00877

RANGE RESOURCES AND WATERSHED MANAGEMENT--A NEED FOR RESEARCH,
Utah State Univ., Logan. Dept. of Range Science.
Gerald F. Gifford.
Utah Science, Utah Agricultural Experiment Station, Utah State University, September 1968, Vol 29, No 3, p 90-91, 2 fig.

Descriptors: *Watershed management, *Land management, *Range management, *Watersheds (Basins), *Optimization, Vegetation, Arid lands, Water conservation, Soil conservation, Precipitation (Atmospheric), Runoff, Overland flow, Utah, Sedimentation, Erosion, Rainfall-runoff relationships, Soil-water-plant relationships, Ranges, Alpine, Multiple purpose projects, Resource development, Research and development, Hydrologic aspects, Water loss, Water utilization, Climatic data.
Identifiers: *Watershed research, *Range-resources research, *Range resources, *Watershed optimization, Turbulent runoff, Plant-soil complexes.

An important function of rangelands is receipt and disposal of precipitation of high and low intensity. Because Utah has abundant range resources, condition and trend of high-and low-elevation vegetation and their soils are important in determining how such areas respond to rain and snow. Knowledge of precipitation and turbulent runoff (overland flow) is requisite to planning by resource managers. Questions arise concerning the occurrence, form, amount, distribution, frequency and modification of rainfall, and erosion, sedimentation, land deterioration, improvement practices, protection criteria, watershed treatment and field analysis. Watershed optimization includes management of (1) soil-cover maintence; (2) multiple range-improvement practices; (3) quantification of flood and sediment-discharge sources; and (4) remedial measures. Multiple-use management requires analysis, protection, repair, utilization and maintenance of watershed areas for optimum control and conservation of water. Through research, education and extension, watershed unknowns may be recognized, defined and quantified. Problems include watershed differences, plant-soil complexes, water interception, cost benefits, erosion minimization, channel losses, chemical defoliation and physiological effect on water loss. These concepts are of particular importance in arid and semiarid areas. (Popkin-Arizona)
W71-00959

FOREST HYDROLOGY AND EXTREME RAINFALL FREQUENCY,
Missouri Univ., Columbia. School of Forestry.
For primary bibliographic entry see Field 02A.
W71-01099

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

STORM WATER POLLUTION FROM URBAN LAND ACTIVITY, DEVELOPMENT OF ANALYTICAL PROCEDURES FOR PREDICTING STORM WATER POLLUTION FROM URBAN AREAS BY USE OF SELECTIVELY DEFINED URBAN CHARACTERISTICS.
Avco Economic Systems Corp., Washington, D.C.

Available from NTIS as PB-195 281, $0.95 in microfiche. Also for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $2.00 SOD I67.13/4: 11034FKL 07/70. Water Pollution Control Research Series, 11034FKL 7/70, July, 1970. 325 p, 89 tab, 66 fig, 29 ref, 14 append. FWQA Program No 11034 FKL, Contract No 14-12-187.

Descriptors: Storm runoff, Storm drains, Urbanization, *Land use, Oklahoma, Cities, *Analytical techniques, Drainage systems, Water pollution control, Pollution abatement.
Identifiers: Tulsa (Okla), *Storm water pollution, Urban runoff.

An investigation of the pollution concentrations and loads from storm water runoff in an urban area was conducted in Tulsa, Oklahoma. The scope of the project included: a field assessment of the storm water pollution by obtaining samples of the water resulting from precipitation and surface runoff from selected test areas within the metropolitan area; development of an analytical procedure for correlation of storm water pollution with selectively defined variables of land uses, environmental conditions, drainage characteristics, and precipitation; and development of a plan for implementing remedial measures necessary to abate or control sources of pollution in an urban area. Storm water runoff samples were collected from 15 'discrete' test areas in the Tulsa metropolitan area for laboratory analysis in terms of quality standards for BOD, COD, TOC, organic Kjeldahl nitrogen, soluble orthophosphate, chloride, pH, solids, total coliform, fecal coliform, and fecal streptococcus pollutants. Selected land use parameters, environmental conditions, drainage and precipitation data, along with storm water pollution factors, provided input data for functional relationships to enable assessment of pollution from storm water runoff. Recommendations were made for a plan of action for preventing and controlling storm water pollution from urban areas.
W71-00619

OIL TAGGING SYSTEM STUDY.
Melpar, Falls Church, Va. Environmental and Applied Sciences Center.

Available from NTIS as PB-195 283, $0.95 in microfiche. Also for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $1.50 per copy. I67.13/4: 15080DJ5/70. Federal Water Pollution Control Research Series DAST-11, May, 1970. 115 p, 7 tab, 8 fig, 174 ref. FWPCA Project 15080 DJQ 05/70, Contract No 14-12-500.

Descriptors: Marking techniques, Tracing techniques, *Tagging, Oil wastes, Oil industry, Pollutant identification, Analytical techniques, Tracers, Chemical analysis, Chromatography, Waste identification, Water pollution control.
Identifiers: *Oil tagging, *Surveillance, Enforcement, *Oil pollution.

Several methods of identifying the source of oil pollution are critically examined. These methods are grouped into two categories: passive tagging and active tagging. Passive tagging assumes that oils are so chemically diverse that their contents constitute a stable chemical fingerprint that can be unequivocally disclosed in the laboratory. Active tagging requires that an inexpensive, coded material be added to oil; this material must be chemically and physically stable in both oil and oil slicks; it must also be readily identifiable by available analytical techniques; and it must have no adverse effect on the oil's subsequent use. Three methods of passive tagging (trace metals, sulfur-isotope ratios, and paper chromatography) and three methods of active tagging (halogenated polycyclic aromatics, organometallies, and coded microspheroids) have been examined. Passive tags cannot be recommended because the passive tags are quite likely to mingle, to evaporate, to be dissolved, or to be oxidized; even if these processes do not occur, they can create formidable forensic problems for the prosecution and telling counter-arguments for the defense. Since active tags are designed to be stable and identifiable, they are satisfactory for the job and the three types of active tags reviewed show promise and merit. (See also W70-04655).
W71-00624

COMPILATION OF DATA FOR MICHIGAN LAKES,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02H.
W71-00637

FERTILIZER USE AND WATER QUALITY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
G. Stanford, C. B. England, and A. W. Taylor.
U. S. Department of Agriculture, ARS 41-168, 1970. 19 p, 1 tab.

Descriptors: *Water quality, *Nitrates, *Phosphates, *Water pollution, *Nutrients, Agriculture, Agricultural chemicals, Farm management, Hydrologic cycle, Water balance, Soil water, Subsurface water.
Identifiers: Nitrogen cycle, Math models of water and nutrient balances, Soil and water conservation.

This publication evaluates the role of nitrogen and phosphorus fertilizers in water pollution and summarizes the research on the complex relationships between nutrient inputs and outputs. Available data do not often permit making valid estimates of nutrient transfer from fertilizer to ground and surface waters. A reliable basis for evaluating the effects of fertilizers on water quality requires quantitative measurements of water inputs and behavior in agricultural watershed studies that encompass appropriate ranges in climatic and management conditions. Future opportunities for manipulating the nitrogen balance in agriculture depend on further improvements in the technology of fertilizer use based on research. Practical methods must be developed for assessing not only the current nitrogen-supplying capacities of soils but also changes that result from fertilizer use. Such estimates, coupled with greater knowledge of nitrogen requirements of crops and of management practices needed for most efficient nitrogen use,

ovide the basis for realistically predicting fertil-
er needs of specific crops and meeting these
eds effectively under different soil and climatic
vironments. Precise control of fertilizer use de-
nds on gaining a better understanding through
search of the behavior of applied nitrogen and
osphorus in soils. For example, leaching and ru-
ff of nitrogen cannot be evaluated without a
tailed understanding of water balance and water
ovement in soils. Also, the chemical and biologi-
l processes of immobilization, mineralization,
d dentrification require further intensive study.
ngland-USDA)
71-00639

**IE EVALUATION OF SPECIES COMPOSI-
ON AS A QUALITATIVE FACTOR IN PRI-
ARY PRODUCTIVITY,**
nerican Univ., Washington, D.C. Dept. of Biolo-
.
r primary bibliographic entry see Field 05C.
71-00647

**ECTRAL ANALYSIS OF WATER QUALITY
LUCTUATIONS IN STREAMS,**
drauli Research Institute, Brno (C-
choslovakia).
Novotny, and I. Schmidtova.
odni Hospodarstri, XIX, No 9, Series 9, 1969, p
7. 3 fig, 1 tab, 7 ref.

scriptors: *Mathematical studies, *Water quali-
Mathematical models, Slushes, Time series anal-
s, Automation, Monitoring, Water analysis,
ater quality control.

e application of harmonic analysis methods is
scribed for the analysis of water quality records.
investigating the spectral density of the records,
possibility is indicated of analyzing the effects
periodic phenomena on the pattern of water
ality changes in various stations. A practical ex-
ple using a computer program showed how to
rry out the analysis of the spectral density of the
a recorded. The results of the analysis then per-
tted the determination of the optimal time for
gle collection, the investigation of the effect of
simple periodic phenomena on the data, and
approximate determination of the error affect-
the statistical evaluation of the water quality at
single station. (Novotny-Vanderbilt)
71-00651

**IE USE OF ISOTOPES IN MEASURING PRI-
ARY PRODUCTIVITY,**
aryland Univ., College Park. Dept. of Botany.
r primary bibliographic entry see Field 05C.
71-00652

**ILOROPHYLL ANALYSIS AS A METHOD OF
VALUATING THE STANDING CROP
IYTOPLANKTON AND PRIMARY PRODUC-
VITY,**
aryland Univ., Solomons. Natural Resources Inst.
r primary bibliographic entry see Field 05C.
71-00657

**AS CHROMATOGRAPHIC DETERMINATION
TOXIC SUBSTANCES AND THEIR
ETABOLITES IN ORGANISM-CONTAINING
QUIDS. II. PHENOL AND p-CRESOL IN
INE (IN GERMAN),**
titute of Labor Hygiene and Occupational Dis-
es, Prague, Czechoslovakia.
Sedivec, and J. Flek.
llection of Czechoslovak Chemical Communica-
ns, Vol 35, No 1, p 242-250, 1970. 3 fig, 14 ref.

scriptors: *Toxins, *Urine, Phenols, Analytical
chniques, Gas chromatography.
ntifiers: p-Cresol, Phosphoric acid, Carbon
ulfide, Dispersion coefficients.

The phenolic compounds of urine are liberated from the coagulated form by heating the sample with phosphoric acid. The sample is extracted with carbon disulfide containing p-nitrochlorobenzol as the internal standard. The extract is heated to 150C with 5% of 20 mole polyethyleneglycol and the contents of phenol and p-cresol are determined by a gas chromatograph. The uncertainly of p-cresol determination is largely excluded because the isomer m-cresol is seldom present in urine. For the optimum results, the hydrolysis of coagulated phenolic compounds should be investigated at different degrees of acidification with the aim of establishing the relation between the aqueous phase dispersion coefficients of phenols and p-cresols and the concentration of phosphoric acid. (Wilde-Wisconsin)
W71-00673

SUGGESTED CLASSIFICATION OF WATER QUALITY BASED ON BIOLOGICAL CHARACTERISTICS,
Wasserwirtschaftsdirektion Werra-Gera-Unstrut, Erfurt (East Germany).
Wolf Von Tumpling.
Proceedings of the Fourth International Conference on Water Pollution Research, held in Prague, 2-6 September 1968, Section I, Paper 16. 8 p, 2 fig, 3 tab, 27 ref.

Descriptors: *Classification, *Water quality, Biological properties, Bioindicators, Regression analysis, Statistical methods, Biochemical oxygen demand, Correlation analysis, Water pollution control, Dissolved oxygen, Oxygen.
Identifiers: Saprobity, *Water quality criteria, Mesosaprobic range, Saprobic index, Ammonium ion.

As a basis of water quality clssification of flowing waters, the author chose the biological state of waters. Four recommended water quality classifications based on organic pollution (biological state) and on oxygen budget are given. Class I includes waters of high purity which is suitable for all uses. Class II includes waters with a moderate pollution load and high self-purifying capacity. Class III waters are highly polluted and have an oxygen budget which is loaded to the limits of aerobic conditions. The author emphasizes the need to consider other water quality criteria such as toxicity and salinity. (Katz-Washington)
W71-00922

AN IMPROVED METHOD FOR PREPARATION OF FECES FOR BOMB CALORIMETRY,
School of Aerospace Medicine, Brooks AFB, Tex.
Hubert G. Lovelady, and Emmett J. Stork.
Clinical Chemistry, Vol 16, No 3, 1970, p 253-254. 1 tab, 2 ref.

Descriptors: *Laboratory tests, Energy, Odor, *Farm wastes, Drying.
Identifiers: *Bomb calorimetry, Lyophilize.

As a preliminary to bomb calorimetry, weighed, homogenized fecal slurries are prefrozen and lyophilized. Advantages of this method over the method of drying in a vacuum oven include: more moisture is removed from the sample initially, drying time is reduced from 48h to 16 h, grinding is eliminated and objectionable odors are eliminated during sample processing. (Christenbury-Iowa State)
W71-00929

A RAPID EXTRACTION AND QUANTIFICATION OF TOTAL LIPIDS AND LIPID FRACTIONS IN BLOOD AND FECES,
Pittsburgh Univ., Pa. Dept. of Pathology.
J. S. Amenta.
Clinical Chemistry, Vol 16, No 4, 1970, p 339-346. 8 fig, 19 ref, 1 tab.

Descriptors: *Lipids, *Laboratory tests, Chemical analysis, Farm wastes.
Identifiers: *Feces, Plasma, Lipid fractions, Clinical laboratory, Cholesterol.

An analytical system for plasma lipids suitable for use in the large and small clinical laboratory is presented. Lipids are extracted into a chloroform-methanol solvent and concentrated into a chloroform phase by a wash with an aqueous CaCl2 solution. This extract is used to estimate total lipids and (after separation by thin-layer chromatography) the major lipid factions. A single acid dichromate reagent is used for all quantification of fecal lipids. Lipids in other body fluids can be conveniently analyzed with this flexible method. (Christenbury-Iowa State)
W71-00937

5B. Sources of Pollution

LEACHING OF CROP RESIDUES AS A SOURCE OF NUTRIENTS IN SURFACE RUNOFF WATER,
Agricultural Research Service, Morris, Minn.; and Minnesota Univ., Morris.
D. R. Timmons, R. F. Holt, and J. J. Latterell.
Water Resources Research, Vol 6, No 5, p 1367-1375, October 1970. 9 p, 8 tab, 8 ref.

Descriptors: *Leaching, *Nutrients, *Runoff, *Water pollution sources, Path of pollutants, Plants, Nitrogen, Phosphorus, Soil-water-plant relationships, Water quality, Eutrophication, Cycling nutrients.
Identifiers: Crop residues, Stubble.

Nitrogen and phosphorus losses were determined in plant leachates from alfalfa, Kentucky bluegrass, barley straw stubble, and oats straw stubble. Plant samples harvested from the field were either leached immediately or were desiccated by drying or freezing before leaching. The extraction of soluble nitrogen and soluble phosphorus in leachates from alfalfa and bluegrass was greatly increased by drying or freezing. These same treatments, however, released only small amounts of soluble phosphorus from barley and oats straw. Estimated soluble nutrient losses indicate that leaching of alfalfa and bluegrass by surface runoff water could contribute substantial amounts of nitrogen and phosphorus to lakes and streams. (Knapp-USGS)
W71-00584

SOIL-WATER SAMPLING USING PAN AND DEEP PRESSURE-VACUUM LYSIMETERS,
Pennsylvania State Univ., University Park. Mineral Conservation Section; and Water and Air Resources Commission, Dover, Del.
For primary bibliographic entry see Field 02G.
W71-00598

BERT V CITY OF ALLIANCE (CITY'S LIABILITY FOR POLLUTION OF RIVER BY SEWAGE TREATMENT PLANT).
For primary bibliographic entry see Field 06E.
W71-00609

DYNAMIC MODEL STUDY OF LAKE ERIE, PART I. SIMILITUDE CRITERIA AND EXPERIMENTAL SET-UP,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
For primary bibliographic entry see Field 02H.
W71-00621

DYNAMIC MODEL STUDY OF LAKE ERIE, PART II, ANALYTICAL AND EXPERIMENTAL RESULTS,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
For primary bibliographic entry see Field 02H.
W71-00622

OIL TAGGING SYSTEM STUDY.
Melpar, Falls Church, Va. Environmental and Applied Sciences Center.
For primary bibliographic entry see Field 05A.
W71-00624

DOES ARTIFICIAL GROUNDWATER RECHARGE CONTAMINATE OUR GROUNDWATERS,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering; Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
Marvin J. Dvoracek, and Rolland Z. Wheaton.
Available from the NTIS as PB-195 304, $3.00 in paper copy, $0.95 in microfiche. Paper presented at the Agricultural Waste Management Conference, Cornell University, Rochester, New York, January 19-21, 1970. 19 p, 32 ref. OWRR Project No B-041-TEX (3).

Descriptors: *Artificial recharge, *Water pollution sources, *Water pollution control, Groundwater, Groundwater movement, Path of pollutants, Water resources development, Water quality.
Identifiers: Groundwater quality protection.

Artificial recharge practices produce the possibility that groundwaters may be polluted or contaminated by undesirable substances introduced with the recharge waters. Various methods of artificial recharge and the contamination potential of each method are discussed. (Knapp-USGS)
W71-00628

WATER QUALITY DEGRADATION BY SEPTIC TANK DRAINAGE,
Maine Univ., Orono. Water Resources Research Center.
Millard W. Hall.
Available from NTIS as PB-195 307, $3.00 in paper copy, $0.95 in microfiche. OWRR Project No A-014-ME (2).

Descriptors: *Eutrophication, *Water pollution sources, *Nutrients, *Septic tanks, *Maine, Soil disposal fields, Phosphates, Adsorption, Ion exchange, Clays, Soil chemistry, Soil chemical properties, Biodegradation, Path of pollutants.
Identifiers: Nutrient retention (Soils).

Phosphorus retention by Maine soils was studied in the Adams, Plaisted, and Paxton soil series. Jar tests were undertaken to determine the rate and extent of phosphorus fixation. Parameters investigated included pH, temperature, soil, particle size, initial soluble phosphorus concentration in the system, and time of exposure. Leaching studies were conducted to determine the effect of various ions on the leaching process, and freeze-thawing experiments were performed to investigate the travel of phosphorus under varying environmental conditions. Soil column studies were conducted, using both an aqueous solution of known phosphorus concentration, and a natural septic tank effluent so that the effects of the soil biota on the retention of phosphorus could be determined. All three soils exhibited a significant capacity for phosphorus retention, but this capacity could be exhausted. Therefore, extreme care should be used in locating septic tank-drainfield waste water disposal systems adjacent to lakes or other surface waters that may be subjected to cultural eutrophication. Moreover, freezing and thawing may allow phosphorus initially retained in the soil to be more easily leached into surface waters. (Knapp-USGS)
W71-00631

THE GAUZE PAD METHOD FOR THE ISOLATION OF VIRUSES FROM INLAND AND ESTUARINE WATERS,
Rhode Island Univ., Kingston. Water Resources Center.
Louise T. Miller, and Oscar C. Liu.
Available from NTIS as PB-195 310, $3.00 in paper copy, $0.95 in microfiche. Completion Report (1970). 12 p. OWRR Project A-025-RI (1).

Descriptors: *Virus elution, *Virus adsorption, *Gauze pad.

The ultimate objective of this study was to examine the viral flora of waters from estuaries, inland ponds and streams of Rhode Island. However, prior to carrying out field examination, it was necessary to evaluate under controlled laboratory conditions these methods currently available for sampling, concentration and isolation of viruses with a view to selecting the most effective method or designing a method which would simplify sampling and improve recovery. The methods evaluated included the gauze pad technique, adsorption and elution from chemical flocs, combined flocculation and centrifugation, sonnication, and finally adsorption and elution from magnetic iron ore. The gauze pad was found to be inefficient for recovering virus from fresh water but its efficiency was enhanced slightly by the presence of inorganic salts in water, e.g., sea water. Combined flocculation and centrifugation improved viral recovery, but shoewed selectivity in the viruses recovered. The best results were obtained by adsorbing virus onto magnetic iron oxide followed by elution with blood serum solutions.
W71-00634

CITY OF LAKELAND V DOUGLASS (MUNICIPALITY'S POLLUTION OF LAKE AS NUISANCE).
For primary bibliographic entry see Field 06E.
W71-00713

THE PAN-AM (OIL POLLUTION BY OIL TANKER IN COASTAL WATERS).
For primary bibliographic entry see Field 06E.
W71-00716

HEGGLUND V UNITED STATES (CRIMINAL PROSECUTION FOR DISCHARGE OF OIL INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-00741

THE EFFECT OF SALINITY ON THE REMOVAL OF SOME ALIPHATIC KETONES,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 05C.
W71-00789

JET DIFFUSION IN STAGNANT STRATIFIED WATERS,
Royal Inst. of Tech., Stockholm (Sweden).
Bengt Gustafsson, and Ian Larsen.
Water Research, Vol 4, No 5, p 353-361, May 1970. 9 p, 4 fig, 6 ref.

Descriptors: *Diffusion, *Jets, *Density stratification, Mixing, Dispersion, Turbulence, Density, Convection, Velocity, Path of pollutants, Density currents, Stagnant water.
Identifiers: Jet diffusion.

The rising of a jet due to buoyancy is discussed with special reference to horizontally injected jets in stratified fluids. A method for calculation of the maximum elevation of the jet is presented. The method is further simplified in the case of linearly varying density. The maximum value of surface density or salinity for which the jet will not be able to rise to the surface may be calculated. (Knapp-USGS)
W71-00835

RADIOACTIVE WASTE DISCHARGES TO THE ENVIRONMENT FROM NUCLEAR POWER FACILITIES,
Bureau of Radiological Health, Rockville, Md.
Joe E. Logsdon, and Robert I. Chissler.
Available from NTIS as PB-190 717, $3.00 in paper copy; and $0.95 in microfiche. Bureau of Radiological Health, Division of Environmental Radiation Report BRH/DER 70-2, March 1970. 77 p, 4 fig, 10 tab, 33 ref, 9 append.

Descriptors: *Nuclear powerplants, *Nuclear wastes, *Radioactive wastes, *Water pollution sources, Surveys, Radioisotopes, Tritium, Nuclear energy, Nuclear reactors, Radioactive waste disposal.
Identifiers: Radioactive waste sources.

Data pertaining to discharges of radioactive liquid and gaseous wastes from nine selected operating nuclear power facilities are presented and discussed. Careful waste management practices, engineered safeguards, and proper operating procedures generally result in radioactivity levels in waste effluents of a few percent or less of the AEC's licensed discharge limits. Exceptions are mostly associated with either an unusually high percentage of leaky fuel elements or with liquid discharge limits which are artificially low as a result of not analyzing liquid wastes for radionuclide content. A number of comparisons were made of power produced versus liquid or gaseous waste discharges. The most predominant trends are that boiling water reactors discharge relatively large quantities of gaseous waste and pressurized water reactors discharge relatively high quantities of tritium in liquid wastes. No obvious trend is discernible concerning quantities of waste discharge as a function of power generation. (Knapp-USGS)
W71-00856

SOURCES OF PESTICIDES IN FLORIDA WATERS,
Geological Survey, Tallahassee, Fla.
Aaron L. Higer, and Milton C. Kolipinski.
Geological Survey Open-file Report 70005, January 1970. 20 p, 1 fig, 3 tab, 13 ref.

Descriptors: *Pesticides, *Water pollution sources, *Florida, Citrus fruits, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Carbamate pesticides, Metal organic pesticides, Data collections, Sampling, Surface waters.
Identifiers: Pesticide use (Florida).

Information on use of pesticides was collected as part of studies of their occurrence in natural waters in Florida. The information is intended for use in designing programs to monitor and trace pesticides in the hydrobiologic system. Use of pesticides in Florida was found to be greatest in the areas of established and expanding agricultural activity, especially the central citrus belt and the north-central and southern truckfarming regions. Approximately 34.0 million pounds of chlorinated hydrocarbon, orgranophosphate, carbamate, and metallo-organic pesticides were used during 1966. Of this total 25.6 million pounds were applied for the control of pests on citrus, vegetables, and melons. Lesser amounts were used on other crops, on lawns, in homes, and for mosquito control. (Knapp-USGS)
W71-00885

THE DEVELOPMENT OF THEORETICAL EQUATIONS TO DESCRIBE THE FLOW OF A RADIOACTIVE ION IN GROUNDWATER, ANNUAL REPORT, DECEMBER 1, 1966 - NOVEMBER 30, 1967,
Geological Survey, Denver, Colo.
David B. Grove.
Report available as SC-CR-68-3637 from NTIS, $3.00 in paper copy, $0.95 in microfiche. Sandia Laboratories, Report SC-CR-68-3637, October 1969. 58 p, 9 fig, 1 tab, 30 ref. Contract AT 848.

Descriptors: *Path of pollutants, *Tracers, *Ion transport, *Porous media, *Groundwater movement, Tracking techniques, Filtration, Ion exchange, Convection, Dispersion, Mathematical models, Hydraulic models, Radioactive wastes, Nuclear wastes, Radioisotopes.
Identifiers: Radioactive ion transport.

A one dimensional transport equation that includes convective, dispersion, and ion exchange terms is derived for the flow of trace concentrations of ions through porous media. Ion-exchange concepts

ined included instantaneous equilibrium, the use theoretical plates, and the assumption of a cond-order kinetic-rate reaction. The theoretical te and kinetic rate ion exchange concept com- red well with laboratory column experiments. e instantaneous equilibrium model's ease of use ts most attractive feature. A general partial dif- ential equation utilizing the kinetic concept to scribe the ion-exchange reaction was formulated o a finite difference equation by means of the ylor's series and solved by a digital computer. A crease in fluid velocity or an increase in the etic rate constant increases the peak concentra- n in the ionic pulse. High fluid velocities or low e constants result in early peaks in the effluent m a laboratory column. (Knapp-USGS)
1-00889

MOSPHERIC AEROSOL: DOES A CKGROUND LEVEL EXIST,
shington Univ., Seattle. Dept. of Atmospheric ences.
primary bibliographic entry see Field 02B.
1-00910

NDS STOP POLLUTION FROM FEEDLOTS,
l Conservation Service, Salina, Kans.
orge R. Smith, and F. DeWitt Abbott.
l Conservation, Vol 34, No 4, Nov 1968, p 78- 2 fig.

scriptors: *Farm wastes, *Water Quality Act, nds, Kansas, Water pollution, Dams, Runoff, l, Sprinkler irrigation.
ntifiers: *Feedlots, Soil Conservation Service, tention ponds, Kansas State Department of alth, Solid waste, Liquid waste.

compliance with the Federal Water Quality Act 1965 and a 1967 Kansas State law a northwest nsas feedlot is retaining and disposing of animal stes in a non-pollutional manner. The 14,000 d beef feedlots is located at the headwaters of a drainage area of Hackberry Creek. The feedlot, ering 100 acres, drains into two intermittent ural draws. Each draw has a pair of detention nds. One collects solid wastes, and below this a ond pond holds drainage from the first pond. es with slide gates provide controlled drainage iquids from the solid-waste ponds into the liquid ste ponds. The dams were built to state health partment standards to contain 3 inches of runoff m the feedlot. The excess water from the lower nds will be used for irrigation. The ponds are flat tomed to facilitate removal of solid wastes. hite-Iowa State)
1-00925

E POTENTIAL DIGESTIBILITY OF CELLU- SE IN FORAGE AND FAECES,
iversity of New England, Armidale (Australia). pt. of Agronomy.
. Wilkins.
rnal of Agricultural Science, Vol 73, No 1, 59, p 57-64. 1 fig, 6 tab, 35 ref.

scriptors: *Farm wastes, *Cellulose, *Digestion, cubation, Grasses, Forages, Sheep, Nitrogen, rbohydrates, Organic matter, Analytical hniques.
ntifiers: *Potential digestibility, *Digestibility fficients, *Cellulose digestibility, Duration of estion, Rumen, Ryegrass, Cooksfoot, Callide odes grass, Samford Rhodes grass, Lignified and inized tissue.

e potential digestibility of cellulose is defined as maximum digestibility obtainable when the nditions and duration of digestion are not limit- factors. Techniques for measuring potential cel- ose digestibility were examined and the relation- p between potential digestibility and in vivo cel- ose digestibility was explored for a range of sses. Cellulose digestibility was found to reach a ximum value after 5 days incubation in vitro. No ther cellulose was digested when the residues from an initial incubation for 6 days were incubated with a second rumen liquor inoculum. The values measured after a single incubation of 6 days duration were similar to cellulose digestibility coefficients measured by the suspension of ground forage samples in nylon bags in the rumen for 6 days. Plant factors appear to limit further digestion and the residue from prolonged digestion in vitro consisted only of lignified and cutinized tissue. Potential cellulose digestibility measured by either of the above techniques was higher than cellulose digestibility in vivo. The difference varied between forages and when the difference was large, the digestibility of cellulose in faeces was high. It is suggested that measurements of the potential digestibility of cellulose in feed and faeces may be of use in estimating the digestibility of grazed herbage. (White-Iowa State)
W71-00926

SALMONELLA Spp. AND SEROTYPES OF ESCHERICHIA COLI ISOLATED FROM THE LESSER MEALWORM COLLECTED IN POULTRY BROODER HOUSES,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
Philip K. Harein, Ernesto De LasCasa, B. S. Pomeroy, and Mabel D. York.
Journal of Economic Entomology, Vol 63, No 1, February 1970, p 80-82. 3 tab, 20 ref.

Descriptors: *Farm wastes, *Poultry, *Salmonella, *E. coli, Cultures.
Identifiers: *Isolated, *Brooder houses, Litter, Mealworms, Pathogens.

Adult Alphitobius diaperinus (Panzer) were collected from the litter of poultry brooder houses in 1967 and 1968. One thousand of the lesser mealworms were individually surface disinfected, mascerated, and cultured in thioglycolate enrichment broth at 37 degrees C and streaked on cosin methylene blue agar or brilliant green agar plates for detection of Escherichia coli (Migula) Castelani and Chalmers and Salmonella spp., respectively. Five species of Salmonella found within the lesser mealworms were identified as S. heidelberg Kauffman, S. worthington Edwards and Bruner, S. saint paul Kauffman, S. typhimurium var copenhagen Kauffman, and S. chester Kauffman and Tesdal. Forty-eight serotypes of E. coli were recovered from within 251 lesser mealworms. Twenty-six of these serotypes are known pathogens for man or animals. (Miner-Iowa State)
W71-00928

INTERNATIONAL SHOE CO V GIBBS (POLLUTION OF STREAM BY MANUFACTURE).
For primary bibliographic entry see Field 06E.
W71-01025

PERRY V SIMPKINS (POLLUTION OF FARM AND STREAM BY FLUORSPAR MINE).
For primary bibliographic entry see Field 06E.
W71-01026

GAUVREAU V GULF REFINING CO (LIABILITY FOR POLLUTION OF WATER BY LEAKING GASOLINE TANK).
For primary bibliographic entry see Field 06E.
W71-01034

ROOT REFINERIES, INC V ROBERTSON (POLLUTION OF FARM STREAM BY OIL REFINERY).
For primary bibliographic entry see Field 06E.
W71-01035

BLANKENSHIP V KANSAS EXPLORATIONS, INC (DAMAGES FOR POLLUTION OF MILLPOND BY MINE SLUDGE).
For primary bibliographic entry see Field 06E.
W71-01036

NORTON COAL MINING CO V WILKIE (POLLUTION OF FARM BY COAL WASHERY).
For primary bibliographic entry see Field 06E.
W71-01038

ROSE V SOCONY-VACCUUM CORP (POLLUTION OF STREAMS BY SUBSTANCES IN GROUNDWATER).
For primary bibliographic entry see Field 06E.
W71-01043

BARRINGTON HILLS COUNTRY CLUB V VILLAGE OF BARRINGTON (DISCHARGE OF SEWAGE INTO RIPARIAN WATERS).
For primary bibliographic entry see Field 06E.
W71-01044

CITY OF CAPE GIRADEAU V HUNZE (MEASURE OF DAMAGES FOR STREAM POLLUTION CAUSED BY CITY SEWAGE DISTRICT).
For primary bibliographic entry see Field 06E.
W71-01047

5C. Effects of Pollution

A NOTE ON BACTERIAL GROWTH AROUND A RECHARGE WELL AT BAY PARK, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
John Vecchioli.
Water Resources Research, Vol 6, No 5, p 1415-1419, October 1970. 5 p, 3 tab, 6 ref.

Descriptors: *Injection wells, *Reclaimed water, *Bacteria, Water reuse, Artificial recharge, New York, Water quality, Tertiary treatment, Aquatic microorganisms, Aquatic microbiology, Aquifers, Water pollution effects.
Identifiers: Bay Park (NY), Long Island (NY).

Highly treated sewage plant effluent is injected into a deep sand aquifer at Bay Park, Long Island, New York. High bacterial counts are observed in water pumped initially from the injection well after recharge termination, even though the injected water generally meets potable standards. Moreover, the number of bacteria recovered during pumping is much larger than the number injected. This suggests a growth of bacteria in the aquifer around the injection well, possibly in part on a filter mat of organic material formed at or near the aquifer-gravel pack interface during injection. Continued pumping results in lower counts until virtually bacteria-free water is produced. However, whenever pumping is stopped and restarted, the initial slug of water pumped shows higher counts than before shutdown. Apparently the surging action of the water dislodges bacteria that otherwise would not enter the well. (Knapp-USGS)
W71-00579

STREAM POLLUTION IN THE 'NEW LEAD BELT' OF S.E. MISSOURI,
Missouri Water Resources Research Center, Columbia.
Bobby G. Wixson, and Hong-Wen Chen.
Available from NTIS as PB-195 285, $3.00 in paper copy, $0.95 in microfiche. Missouri Water Resources Research Center, Completion Report, August 1970. 17 p, 1 tab, 5 fig, 11 ref. OWRR- A-021-MO (1).

Descriptors: *Mining, *Lead, *Zinc, Water quality, Fluorides, Missouri, Water pollution effects.
Identifiers: Milling Reagents.

This project studied the effects of lead-zinc mining and milling pollution in the Viburnum Trend or 'New Lead Belt' of S.E. Missouri. Results obtained from the project included the following: Stream pollution below the mine discharge was mainly due to the growth of large algal mats of Oscillatoria and bacteria which appear to result from the discharge of sodium isoprophyl xanthate in the milling waste

water. Limits were established for the precipitation of lead, zinc, and copper in relationship to pH and other water quality parameters. The amount of fluorides in the streams may be used as an indicator of mining water discharges. New techniques may be used to evaluate organic milling reagents in the water and in the biota. Diatoms may be used as biological indicators of mine waste water effects.
W71-00627

WATER QUALITY DEGRADATION BY SEPTIC TANK DRAINAGE,
Maine Univ., Orono. Water Resources Research Center.
For primary bibliographic entry see Field 05B.
W71-00631

POTENTIAL THERMAL EFFECTS OF AN EXPANDING POWER INDUSTRY: UPPER MISSISSIPPI RIVER BASIN,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
D. E. Peterson, and R. T. Jaske.
AEC Research and Development Report, BNWL-1405, UC-70 June, 1970, p 94. 22 fig, 21 tab, 17 ref. US AEC Contract AT (45-1)-1830.

Descriptors: *Thermal pollution, *Temperature, Computer models, Flow, Thermal power plants, Ice, Navigation, Precipitation (Atmospheric), Run off, Heat budget, Computer programs, Minnesota, Illinois, *Simulation, *Model studies.
Identifiers: Upper Mississippi, River Basin, Cooling capacity, Power growth, Heat sink, Thermal load.

Direct cooling capacities of the main stem Mississippi River and eight major tributaries between Royalton, Minnesota and Alton, Illinois for average and low flow conditions were simulated within a temperature constraint of 5F above natural background. Total assimilative and dissipative capacity of the upper Mississippi Basin ranged from a high of 130 GWT to a low of 46 GW sub T. Analyses of projected power growth patterns indicate that the main stem has adequate cooling capacity to accommodate forecasted loads through the year 1990, except in the St. Paul-Minneapolis area. Partial recirculatory cooling facilities appear to be a possible solution to tributary basin cooling water requirements beyond the year 1980. (Upadhyaya-Vanderbilt)
W71-00644

SIMULATION OF THE EFFECTS OF HANFORD AT THE WASHINGTON-OREGON BORDER,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
R. T. Jaske, and D. G. Daniels.
U. S. AEC Contract AT (45-1)-1830. AEC Research and Development, BNWL-1344, VC-70, July, 1970, p 33. 16 fig, 2 tab, 4 ref.

Descriptors: *Thermal pollution, Temperature, *Mixing, Isotherms, *Stratification, Heat transfer, Reservoirs, Depth, Oregon, Washington, Model studies, *Simulation.
Identifiers: Hanford plant, COLHEAT simulation model, Thermal discharge, Power level, Temperature transect, Columbia River.

A series of transects taken in the summer and fall of 1969 at the Oregon and Washington border are used as the basis for checking the accuracy of the COLHEAT simulation model and the extent of stratification and mixing which occurs in the reservoir under conditions where solar thermal input is at a maximum. The model is then used to estimate the extent to which heat additions at the Hanford Plant (Columbia River Mile 382) persist to the Washington-Oregon border (River Mile 308) under a range of statistically determined extreme and normal conditions expected after completion of the Columbia Treaty dams in 1975. The results show that 65% or more of the incremental addition to the temperature of the Columbia River between Priest Rapids dam and Richland is dissipated in the reach under study. The remaining 35% is only weakly related to the weather in terms of yearly variations. The study suggests the practicability of using computer simulation as the basis for management of stream standards using in situ stream conditions as the basis of the judgment. (Upadhyaya-Vanderbilt)
W71-00645

THE EVALUATION OF SPECIES COMPOSITION AS A QUALITATIVE FACTOR IN PRIMARY PRODUCTIVITY,
American Univ., Washington, D.C. Dept. of Biology.
Richard R. Anderson.
Chesapeake Science, Vol 10, No 3 and 4, Sept-Dec, 1969, p 307-312. 28 ref.

Descriptors: *Phytoplankton, *Chlorophyll, *Benthos, Marshes, *Periphyton, Sampling, Aquatic environment.
Identifiers: Infrared photography, Thermal addition, Cell count.

The older and largely obsolete method for sampling phytoplankton communities is the fine silk net. Problems encountered include variations in pore size due to manufacture degree of wetting, age and strain. Pumping known volume of water through suitable filters, which then can be washed to retrieve the phytoplankton, appears to solve sampling problems. Counting trays such as the Russel model or hemocytometer slide are used for determination of species and cell number with a microscope. Benthic and Periphylic plants make ideal indicators of species and biomass change within an area where environmental alteration is occurring, since the adults do not readily move to new areas. Investigations using SCUBA and underwater photography are only useful in water with relatively little sediment load. Bottom grabs or dredges appear to best facilitate benthos sampling. Anderson has found color in delineating major marsh plant communities. (Upadhyaya-Vanderbilt)
W71-00647

MEASURING DISSOLVED OXYGEN AS AN INDICATOR OF PRIMARY PRODUCTIVITY,
Rutgers-The State Univ., New Brunswick, N.J.
Kent Mountford.
Chesapeake Science, Vol 10, No 3 and 4, Sept-Dec, 1969, p 327-330. 14 ref.

Descriptors: *Dissolved oxygen, *Primary productivity, Polarographic analysis, Calibrations, Aquatic environment.
Identifiers: Light-dark bottle, Winkler method, Carbon fixation, Microgasometry, Manometry.

The estimation of primary productivity using dissolved oxygen data is predicted upon the relationship between oxygen evolution and carbon fixation. In the current Barnegat Ray investigation, the change in mg O2/l was multiplied by 0.375 to obtain a first order approximation of fixation of carbon into organic compounds. Gaarder and Gran first proposed the technique using light and dark bottles with the Winkler titration to measure the production and consumption of oxygen. The contribution of oxygen dissolved in the reagents, volatilization and air-oxidation of iodine in the transfer at aliquots for titration, and direct errors in burette reading and detection of the end point are the sources of error in the Winkler method. Polarographic techniques and their advantages are also described. Scholander described an elegant technique which requires only about 1 ml of sample for the determination of dissolved oxygen, even in polluted waters, with an accuracy of 2 percent. Manometry does not require the measurement of oxygen to estimate carbon fixation and, indeed can directly measure changes in CO2. (Upadhyaya-Vanderbilt)
W71-00649

THE USE OF ISOTOPES IN MEASURING PRI MARY PRODUCTIVITY,
Maryland Univ., College Park. Dept. of Botany.
Raymond A. Galloway.
Chesapeake Science, Vol 10, No 3 and 4, September - December 1969, p 331-335. 55 ref.

Descriptors: *Radioisotopes, *Primary productivity, Radioactivity, Incubation, Sampling, Time *Biomass, *Aquatic microorganisms.
Identifiers: 14C, Photosynthate, Dark fixation, Activity.

Primary production is most often based on either the rate of carbon assimilation or the rate of oxyge production. One of the most sensitive measures primary production is by 14C-technique original developed by Steemann and Nielsen (J. Con Perm. Int. Explor. Mer. 18: 117-140, 1952). Me sured water samples are placed in bottles togeth with known amounts of 14C, usually in the form bicarbonate. Bottles were exposed to approximat ly 2000 foot-candles of illumination for 3 to 6 hou in a bath. After incubation, cells were filtered a washed in sea water. The filters were dried for hours and exposed to fuming HCL to remove absorbed organic carbon before making radioa tive counts. Time and sampling are the problem this procedure. Another problem inherent in t approach is that of dark CO2 fixation. Loss of 1 can also occur from normally functioning, livi cells. Contains 55 references. (Upadhyaya-Va derbilt)
W71-00652

EFFECT OF TEMPERATURE ON OXYGE TRANSFER IN WATER,
Windsor Univ. (Ontario); Tennessee Val Authority, Chattanooga; and Wisconsin Un Madison.
Jatinder K. Bewtra, William R. Nicholas, and Lawrence B. Polkowski.
Water Research, 1970. Vol 4, No 1, p 115-1 January 1970. 5 fig, 1 tab, 11 ref.

Descriptors: *Temperature, *Aeration, Reae tion, Regression analysis.
Identifiers: Saran tubes, Spargers, Oxygen trans rates, Air flow rates.

The effect of temperature on oxygen transfer diffused-air aeration is presented. The study made in a full scale aeration tank using both sa tubes and spargers as the diffusion media at a tion rates from 7 to 32 ft 3 per min. per foot of t length. The oxygen transfer was measured in w through a temperature range of 10-30C in 2.5C crements. In an aeration tank with bubble aera at a given rate, the percent ratios of the rates of ygen absorbed to the oxygen supplied in tap w are the same, at temperatures between 10C 30C and zero dissolved oxygen concentration. value of K sub L A changes with temperature according to the equation (K sub L A) sub T e (K sub L A)20C (T-20), where A is the interfa contact area between air bubbles and liquid, a sub L is the over all transfer coefficient. The v of C for the aeration devices, saran tubes, and s gers, was found to be 1.0192. Airflow rates w the range of 7-32 cu ft per min per foot tank le have no significant effect on this constant. (U hyaya-Vanderbilt)
W71-00654

CHLOROPHYLL ANALYSIS AS A METHOD EVALUATING THE STANDING C PHYTOPLANKTON AND PRIMARY PROD TIVITY,
Maryland Univ., Solomons. Natural Resources
David A. Flemer.
Chesapeake Science, Vol 10, No 3 and 4, tember-December 1969. p 301-306. 51 ref.

Descriptors: *Chlorophyll, *Primary product Standing crop, *Phytoplankton, Aquatic env ment.
Identifiers: Assimilation number, Absorption ficient.

ie accuracy of chlorophyll a determination is sub-
ct to important errors resulting from chlorophyll
gradation products, as are determinations for
ier chlorophylls which have absorption maxima
ar that of chlorophyll a. This problem is espe-
lly likely to occur in shallow estuaries where bot-
n deposits are resuspended by wind and tidal
rrents or in samples collected from fixed sub-
ates, e.g., glass slides. Choice of specific absorp-
n coefficient, and the nature of pure pigments
ed for calibration can affect the spec-
photometric estimation of chlorophyll. (Upad-
aya-Vanderbilt)
71-00657

FORMATION PROCESSING IN WATER SOURCES RESEARCH,
Brien and Gere, Syracuse, N.Y.
r primary bibliographic entry see Field 07B.
71-00662

ASONAL VARIATION IN SELECTED TRIENTS OF A RIVER SYSTEM,
elph Univ. (Ontario). Dept. of Zoology.
R. MacCrimmon, and J. R. M. Kelso.
urnal Fisheries Research Board of Canada, Vol
, No 5, p 837-846, 1970. 2 fig, 2 tab, 15 ref.

scriptors: *Fluctuation, *Nutrients, *River
tems, *Water pollution effects, Sampling, Water
emistry, Municipal wastes, Agricultural
tersheds, Dissolved oxygen, Carbon dioxide,
drogen ion concentration, Alkalinity, Hardness
ater), Ammonia, Nitrates, Silicates, Chlorides,
trites, Phosphates, Iron, Sulfates, Industrial
stes, Great Lakes region, Swamps, Temperature,
ater pollution sources, Cycles.
entifiers: Grand River (Ontario), Seasonal varia-
ns.

and River, Ontario, headwater nutrient levels
d associated water chemistry were radically al-
ed by the influence of a small city. Extreme
els of nitrogen, spectacular changes in
osphate, and the chronic summer depletion of
solved oxygen appeared below Guelph.
covery processes occurred downriver in a
marily agricultural watershed. Dissolved oxygen
els, carbon dioxide, pH, alkalinity, hardness,
mmonia, nitrate, and silica followed similar
asonal patterns at all test locations. High and
dely fluctuating levels of chloride, ammonia,
rate-nitrogen, nitrite, and orthophosphate were
idence of gross enrichment; nitrate-nitrogen,
thophosphate, iron, and sulfate levels varied ir-
gularly during the 13-month observation period
ugust 1967-September 1968). Variations in
trient levels and associated chemical conditions
ow the limitation of spot sampling in assessment
water quality, particularly if natural nutrient
els and the pattern and range of these fluctua-
ns are unknown; it is only through publication of
thodology and long-term investigations, that the
nited knowledge of the complex chemistry of
er water can be expanded so that increasing
trophication and water quality control may be
tter understood and dealt with effectively.
nes-Wisconsin)
71-00664

OTTOM FAUNA AND EUTROPHICATION,
penhagen Univ., Hillerod (Denmark). Fresh-
ter-biological Lab.
tur M. Jonasson.
trophication: Causes, consequences, cor-
ctives, p 274-305. Printing and Publishing Office,
tional Academy of Sciences, Washington, DC,
69. 10 fig, 3 tab, 47 ref.

escriptors: *Benthic fauna, *Eutrophication,
utrients, Lakes, Ecology, Primary productivity,
gae, Plankton, Submerged plants, Physicochemi-
l properties, Phytoplankton, Distribution, Depth,
ygen, Alkalinity, Hydrogen ion concentration,
anding crop, Light, Biomass, Respiration, Life
cles, Oligochaetes, Mollusks, Stratification,
atoms, Chlorophyta, Cyanophyta, Daphnia,
ails.

Identifiers: Lake Ersom (Denmark).

Bottom fauna fits into an ecological pattern set by primary production of algae, submerged macrophytes, and physical and chemical factors. The physicochemical factors affect size and seasonal trend of primary production. In turn, primary production determines range of various physical and chemical factors at the bottom. Phytoplankton production, vertical distribution and abundance of macrophytes are important determinants of oxygen regime, alkalinity, pH, and other factors especially important in relation to vertical and temporal variation. Bottom fauna is correspondingly affected in quality, quantity, and depth distribution. Above the thermocline is a rich fauna with high oxygen demands; below the thermocline are a few specialists tolerating low oxygen tension. These qualitative contrasts are paralleled by quantitative contrasts. Increasing nutrients to epilimnion results in increased standing crop and phytoplankton production. Macrophytes climb to compensate for decreased illumination. Lake changes into one devoid of submerged vegetation, dominated by Nymphoids showing only the lower peak of animal biomass. Increasing nutrients to hypolimnion causes rapidly developing oxygen deficit, lowering respiratory activity, reducing growth periods, and other adverse effects on bottom fauna. During final stage of eutrophication, sessile mud-dwellers may drop to almost zero or become restricted to Oligochaetes. (Jones-Wisconsin)
W71-00665

PHYSIOLOGICAL-ECOLOGICAL STUDIES OF BENTHIC ALGAE IN LABORATORY STREAMS,
Oregon State Univ., Corvallis. Dept. of Botany.
For primary bibliographic entry see Field 07B.
W71-00668

INTERACTION OF PESTICIDES WITH NATURAL ORGANIC MATERIAL,
Geological Survey, Denver, Colo.
R. L. Wershaw, P. J. Burcar, and M. C. Goldberg.
Environmental Science and Technology, Vol 3, No 3, p 271-273, 1969. 3 fig, 1 tab, 9 ref.

Descriptors: *Pesticides, *DDT, 2-4-5-T, Adsorption, Solubility, Organic matter, Water pollution, Humic acids, Surface tension.
Identifiers: Organic polyelectrolytes, Langmuir adsorption equation, Lauryl sulphate solution.

By lowering the surface tension of water, organic polyelectrolytes, such as humic acid, facilitate solubility of otherwise insoluble pesticides. On the other hand, the high adsorption capacity of humate fraction precludes an uptake of eradicants by the roots. These relationships were demonstrated by the use of sodium humate and humic acid to solubilize the DDT and adsorb the 2,4,5-T from solution. (Wilde-Wisconsin)
W71-00674

STREAM OF ENERGY IN THE ECOSYSTEM OF AN EUTROPHIC LAKE (IN RUSSIAN),
Akademiya Nauk SSSR. Zoologicheskii Institut.
For primary bibliographic entry see Field 02H.
W71-00678

TROPHIC NATURE OF SELECTED WISCONSIN LAKES,
Wisconsin Dept. of Natural Resources, Madison. Div. of Environmental Protection.
For primary bibliographic entry see Field 02H.
W71-00682

A PREDATOR-PREY RELATIONSHIP. SEA STARS-BIVALVES. THE CHEMICAL BASIS OF THE RESPONSE OF ASTERIAS VULGARIS TO CRASSOSTREA VIRGINICA. A BIOASSAY, ITS APPLICATIONS AND THE PARTIAL PURIFICATION OF AN ACTIVE EXTRACT,
Woods Hole Oceanographic Institution, Mass.
K. J. Whittle, and M. Blumer.
Available from NTIS as AD-708 682, $3.00 in paper copy, $0.95 in microfiche. Technical Report, May 1970. 77 p. Reference No 70-20.
Identifiers: *Echinodermata, Responses, *Pelecypoda, Secretion, *Secretion, Chemical analysis, Chemicals, Stimulation, Purification, Ecology, Water pollution, Oceans, Sensory perception, Thresholds (Physiology), Sensitivity, Marine biology, Biological assay, *Asterias vulgaris, *Crassostrea virginica, *Chemotaxis, *Predation.

The chemical basis of the predator/prey relationship, sea stars/bivalves, was examined. Under controlled conditions in a flow-tank, Asterias vulgaris senses intact oysters (Crassostrea virginica) upstream at distances of at least 120 cm. and shows a positive chemotaxis. It responds similarly to aqueous extracts of oyster tissue at concentrations as low as a few parts per billion. The threshold sensitivity of Asterias vulgaris and Asterias forbesi for an oyster extract was compared. It was measured also for A. vulgaris relative to other bivalves. Contamination of the testing tank with particulate suspensions and oil dispersions at concentrations of less than 10 10 mg/liter is sufficient to decrease the response to oyster extract and to lower the threshold sensitivity of the sea stars. A reliable, repeatable method was developed for the partial purification of the oyster extract. Infrared spectroscopy indicates that the major functional groups are -OH, -NH and -COOH. It is probable that the activity is centered in a number of polar, low molecular weight compounds. They are heat stable at 100C stable to acid, and not hydrolyzable.
W71-00787

THE EFFECT OF SALINITY ON THE REMOVAL OF SOME ALIPHATIC KETONES,
Texas A and M Univ., College Station.
Tariq A. Mahmoud, and William B. Davis.
Available from NTIS as PB-193 401, $3.00 in paper copy, $0.95 in microfiche. July 1970, 106 p. Sea Grant Publication No. TAMU-SG-70-216.
Identifiers: *Water pollution, *Organic compounds, *Microorganisms, Salinity, Ketones, Aliphatic compounds, Wastes (Industrial), Control, Metabolism, Estuaries, Physiology, Bacteria, Pseudomonas, Fungi, Theses, Cephalosporium.

Basic and definitive information pertaining to the effect of salinity on the microbial behavior is essential to determine the fate of organic pollutants discharged into the estuaries, and to determine design and operation parameters of plants subjected to salinity variation. Twenty-five batch tests were run to determine the long and short term effect of salinity variation on the microbial behavior of cultures established in various salinity levels and tested under different salinity conditions. Aliphatic ketones namely, acetone, 2-butanone and 2-pentanone were used as a carbon source in this study because of their appearance in many industrial wastes. Organisms acclimated to ketones in media varying from fresh water to sea water salinity were identified to genera and in two instances to species. The following conclusions were observed: (1) Two predominant genera, Cephalosporium and Psendomonas, were common to all salinity levels. (2) Minor species were displaced with the progressive increase in salinity level. These two observations lend credence that a reduced removal rate at a higher salinity level was due not to the change in population structure but to the physiological effects of the increase salinity on the uptake and metabolism of the substrate by organisms.
W71-00789

PRIMARY PRODUCTIVITY, CHEMO-ORGANOTHROPHY, AND NUTRITIONAL INTERACTIONS OF EPIPHYTIC ALGAE AND BACTERIA ON MACROPHYTES IN THE LITTORAL OF A LAKE,
Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 02H.
W71-00832

STUDIES ON WATER QUALITY AND THE ABSENCE OF FISH FROM SOME POLLUTED ENGLISH RIVERS,
Water Pollution Research Lab., Stevenage (England).
V. M. Brown, D. G. Shurben, and D. Shaw.
Water Research, Vol 4, No 5, p 363-381, May 1970. 19 p, 12 fig, 8 tab, 24 ref.

Descriptors: *Water pollution effects, *Toxicity, *Fishkill, *Poisons, Estuaries, Fish, Morbidity, Mortality, Industrial wastes, Water pollution, Rivers, Water quality, Ammonia, Copper, Phenols.
Identifiers: Cyanide, Zinc, England.

Field studies were made in England to determine the acute, lethal toxicity of some polluted river waters and an estuary water to rainbow trout, brown trout, roach, and dace. The 48 hr median lethal concentrations, for rainbow trout, of dilutions of the polluted fresh waters were found to be about 65 per cent of those predicted from the chemical qualities of the waters. Prediction seriously underestimated the toxicity of the saline waters. (Knapp-USGS)
W71-00834

EFFECTS OF COPPER ON GAMMARUS PSEUDOLIMNAEUS, PHYSA INTEGRA, AND CAMPELOMA DECISUM IN SOFT WATER,
National Water Quality Lab., Duluth, Minn.
John W. Arthur, and Edward N. Leonard.
Journal of the Fisheries Research Board, Canada, Vol 27, No 7, p 1277-1283, 1970. 5 tab, 12 ref. FWQA Program 18050---9/70.

Descriptors: *Heavy metals, *Copper sulfate, *Amphipoda, *Snails, *Bioassay, Life history studies, Toxicity.
Identifiers: *Chronic copper toxicity, *Acute copper toxicity, Safe toxicity levels, Continuous flow bioassays.

Three invertebrate species were subjected to acute (96-hr) followed by long-term (6-week) copper exposures under continuous flow bioassay conditions. Survival, growth, reproduction, and feeding were the responses used for measuring toxicant effects. The average 96 hr TLm values for Campeloma decisum, Physa integra, and Gammarus pseudolimnaeus were 1.7, 0.039, and 0.020 mg/liter total copper, respectively. The total copper concentration having no effect after 6 weeks' exposure for all three species, was between 8.0 and 14.8 micrograms/liter. The newly hatched amphipods obtained from the second six week study were exposed to copper for 9 additional weeks, and grew to the adult stage only in copper concentrations less than or equal to 4.6 micrograms/liter. After 5 weeks' exposure to a water system, survival of newly hatched Gammarus was markedly reduced between copper concentrations of 12.9 and 6.2 micrograms/liter.
W71-00907

CHRONIC EFFECTS OF LINEAR ALKYLATE SULFONATE DETERGENT ON GAMMARUS PSEUDOLIMNAEUS, CAMPELOMA DECISUM, AND PHYSA INTEGRA,
National Water Quality Lab., Duluth, Minn.
John W. Arthur.
Water Research, Vol 4, No 4, p 251-257, 1970. 4 tab, 17 ref. FWQA Program 18050---10/70.

Descriptors: *Detergents, *Amphipoda, *Snails, *Bioassay, Toxicity, Life history studies.
Identifiers: *Chronic detergent toxicity, *Acute detergent toxicity, Safe toxicity levels, Continuous flow bioassays.

Three invertebrate species were submitted to acute (96 hr) followed by chronic (6 week) detergent exposures. The average 96 hr TLm values for Campeloma decisum, Physa integra, and Gammarus pseudolimnaeus were 27, 9, and 7 mg/l linear alkylate sulfonate (LAS), respectively. Newly hatched amphipods that were covered after termination of the second 6 week study were further exposed to the detergent for 15 additional weeks, thus enabling more than one generation cycle to be tested under toxicant stress. Survival, growth, reproduction, feeding, and mobility were the responses used for determining the chronic toxicant effects. Under the test conditions described, the maximum acceptable LAS concentrations for Gammarus pseudolimnaeus and Campeloma decisum were between 0.2-0.4 and 0.4-1.0 mg/l, respectively. Responses by Physa integra were not significantly altered under the chronic test concentrations.
W71-00908

EFFECTS OF ABATEMENT OF DOMESTIC SEWAGE POLLUTION ON THE BENTHOS, VOLUMES OF ZOOPLANKTON, AND THE FOULING ORGANISMS OF BISCAYNE BAY, FLORIDA,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
Kneeland J. McNulty.
Studies in Tropical Oceanography No 9, University of Miami Press, Coral Gables, Florida, March 1970. 107 p, 19 fig, 10 tab, 155 ref. FWQA Program 18050-03/70.

Descriptors: *Water pollution effects, Domestic wastes, *Pollution abatement, Water pollution control, Benthos, *Benthic fauna, *Benthic flora, Zooplankton, Florida, Comparative productivity, Aquatic environment, Aquatic populations, Dredging, *Bottom sediments, Phosphorus, *On-site investigations, On-site data collections, Amphipoda, Water quality.
Identifiers: Fouling organisms, *Biscayne Bay, Florida, Barnacles, *Bottom communities, Literature review.

Various elements of the biota of northern Biscayne Bay, Florida, were studied before and after abatement of pollution. The pollution consisted of 136 to 227 million liters per day of untreated domestic sewage. Four years after removal of the pollution certain changes had taken place. At distances of 100 to 740 meters seaward from outfalls, in water depths of one to three meters in hard bottom, populations of benthic macroinvertebrates had declined from abnormally large numbers of species and individuals to normal numbers of each, while soft-bottom populations had changed qualitatively but not quantitatively. Adjacent to outfalls, populations had increased in numbers of species and numbers of individuals in hard sandy bottoms only. Volumes of zooplankton had decreased to about one-half the pre-abatement values in poorly flushed waters; elsewhere, they remained about the same. Dissolved inorganic phosphate-phosphorus decreased similarly. Abundance of amphipod tubes had declined markedly, a change not shared by the quantities of other fouling organisms (including barnacles), which remained about the same. There was no evidence of improved commercial and sport fishing following abatement; this is interpreted to mean that long-lasting detrimental effects have resulted from pollution and dredging. (Katz-Washington)
W71-00919

INFLUENCE OF OXYGEN CONCENTRATION AND WATER MOVEMENT ON THE GROWTH OF STEELHEAD TROUT AND COHO SALMON EMBRYOS,
Oregon State Univ., Corvallis. Dept. of Fish and Game Management.
Dean L. Shumway, Charles E. Warren, and Peter Doudoroff.
Transactions of the American Fisheries Society, Vol 93, No 4, 1964, p 342-356. 10 fig, 3 tab, 3 ref.

Descriptors: *Water pollution effects, Oxygen requirements, *Dissolved oxygen, Water temperature, *Fish eggs, Fish management, Fish physiology, Growth rates, Environmental effects, *Embryonic growth stage, *Hatching, Laboratory tests, Salmonids, Mortality, Regression analysis, Viability.
Identifiers: *Coho salmon, *Steelhead trout, *Water movement, Water velocities, Hatching time.

Embryos of coho salmon and steelhead trout were reared from fertilization of the eggs to hatching, at about 10 degrees C, at different concentrations of dissolved oxygen ranging from about 2.5 to 11.5 mg/liter and at different water velocities ranging from about 3 to 750 cm/hour. Some of the embryos rested on porous plates, while others were buried in glass beads so as to simulate natural conditions more closely. Fry from embryos reared at low and intermediate oxygen concentrations hatched later and were smaller in size at hatching than fry from embryos reared at concentrations near the air-saturation level. At all oxygen concentrations tested, reduced water velocities resulted in reduced size of hatching fry. This effect of velocity was nearly as pronounced at high oxygen concentrations as at low concentrations. The effect of the difference of water velocity tested was less than the effect of the difference of oxygen concentrations tested. When some embryos were buried in glass beads while others were not, and the discharge rates of water through cylinders containing the embryos were the same, the fry that hatched in the cylinders containing beads were larger in size than those in cylinders without beads. This effect is ascribed to the increase of water velocities around the embryos buried in beads. It was usually most pronounced when a mixture of large and small beads was used. (Katz-Washington)
W71-00920

THE ACUTE LETHAL TOXICITY TO RAINBOW TROUT OF MIXTURES OF COPPER, PHENOL, ZINC AND NICKEL,
Water Pollution Research Lab., Stevenage (England).
V. M. Brown, and R. A. Dalton.
Journal of Fisheries Biology, Vol 2, p 211-21 1970. 2 fig, 3 tab, 11 ref.

Descriptors: *Bioassay, Toxicity, *Copper, *Phenols, Heavy metals, Rainbow trout, Lethal limit, Water pollution effects, Copper sulfate, Estimating.
Identifiers: *Zinc, Nickel, Toxic mixtures, Fractional toxicities, *Predicted toxicity.

The acute lethal toxicities to rainbow trout, Salmo gairdneri Richardson, of mixtures of copper and phenol, of copper, zinc and phenol, and of copper, zinc and nickel, over an exposure period of 48 were determined. The 48 - h LC50 values were 1.17, 1.07, and 1.01 mg/l, respectively. The concentrations selected for testing were such that each poison theoretically contributed equally to the toxicity of the mixture. It was found that the toxicity of these mixtures could be adequately predicted by summation of the fractional toxicities of the particular poisons which were present. (Katz-Washington)
W71-00921

THYROXINE ANTAGONISM OF PENTACHLOROPHENOL POISONING IN CICHLID FISH,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
James N. Pasley, George G. Chadwick, and Hugo Krueger.
Proceedings of the Western Pharmacology Society II, p 129-132, 1968. 3 tab, 12 ref. USPHS Grants ITI GM 1192 and EF 105.

Descriptors: Phenols, Cichlids, *Fish physiology, Mode of action, Animal metabolism, *Biochemistry, *Growth rates, Lipids.
Identifiers: *Thyroxine, Antagonism, *Pentachlorophenol, Ash content, Protein content.

Control cichlids had higher wet weight, dry weight, lipid and water content than the cichlids exposed to thyroxine (T) alone or to sodium pentachlorophenol (NaPCP) alone. Protein and

ıtent of control cichlids did not vary markedly m those exposed to thyroxine or to NaPCP. The nbination of T.. NaPCP led to an increase in wet ight, dry weight, and lipid and protein fraction ıtent above that of control cichlids. Thyroxine ne and NaPCP alone reduced growth, but when hlids were exposed to a combination of both stances a somatotropic effect was exerted. The nges from controls in weights of water, fat, ash, protein fraction were not proportional and thus osure to Thyroxine, NaPCP, and T..NaPCP al- ed the composition of the cichlids. (Katz- shington)
1-00923

FECT OF DIETS CONTAINING HYDRATED POULTRY WASTE ON QUALI- CHANGES IN SHELL EGGS DURING ORAGE,
chigan State Univ., East Lansing. Dept. of ltry Science.
R. York, C. J. Flegal, H. C. Zindel, and T. H. eman.
ltry Science, Vol 49, No 2, p 590-591, March 0. 1 tab, 3 ref.

criptors: *Farm wastes, *Poultry, *Dehydra- , *Diets, Eggs.
ntifiers: *Haugh unit, *Qaulity changes, Color odor observations, Waste feeding, Manure ization, Dried poultry wastes.

s from 32 Leghorn-type hens on each of four s were used. All the birds were 10 months of and had been on the experimental diet for three nths. The diets used were (1) control, (2) con- with 10% DPW, (3) control with 20% DPW, (4) control with 30% DPW. One-day-old eggs e stored at room environment to accelerate the nges that occur during storage. Room tempera- varied from 22 degrees C to 25 degrees C and tive humidity varied from 50% to 68%. Eggs e gathered on five consecutive days and held storage periods of 10, 20, 30, 40 or 50 days. sical and microbiological examinations were le at the beginning of the trial and at the end of designated storage periods. The results of this eriment indicate that including 10, 20, or 30% ydrated poultry waste in the diet of hens had no ificant deleterious effect on the quality of shell s as measured by Haugh units, storage weight , color, odor, and/or microbial content. (Miner- a State)
1-00930

E EFFECT OF ANIMAL DENSITY AND SUR- CE SLOPE ON CHARACTERISTICS OF RU- FF, SOLID WASTES AND NITRATE MOVE- NT ON UNPAVED BEEF FEEDLOTS,
raska Univ., Lincoln. Agricultural Experiment ion.
. Gilbertson, T. M. McCalla, J. R. Ellis, O. E. ss, and W. R. Woods.
lication SB508, June 1970. 23 p, 5 fig, 7 tab, 23

criptors: *Rainfall-runoff relationships, emical analysis, *Farm wastes, Chemical ox- n demand, Biochemical oxygen demand, Cattle, oratory tests, Detention reservoirs, Nitrates, sphorus.
ntifiers: *Dry matter removed (DMR), *Dry ter feces (DMF), Volatile solids, Feedlot slope, le densities, Soil core samples, Feedlots.

objectives of this study were to determine the ct of feedlot slope and cattle densities on: (1) quantity and quality of runoff resulting from storms and snowmelt, (2) Downward move- t of pollutants into the soil profile on unpaved lots, and, (3) Amount of solids accumulation he feedlot surface. Pairs of feedlots with 3, 6, 9% slopes were installed. Ten and twenty cattle e placed in each pair of feedlots, which allowed and 100 sq. ft. of area per animal. Volumetric surement of runoff resulting from rainfall and wmelt were made and samples of each runoff occurrence were taken to the laboratory for analysis. Laboratory analyses included pH, electric conductivity, total solids, non-volatile solids, total nitrogen, ammonium, nitrate, total phosphorus, COD and BOD. Soil cores were taken to depths of 14 ft. below the feedlot surface and adjacent buffer strips to determine downward movement of contaminants into the soil profile. Solids accumulations on the lot surface were removed twice. Weights of material removed were recorded and composite samples were taken to the laboratory for analyses. (Christenbury-Iowa State)
W71-00931

INFLUENCE OF POULTRY-MANURE-REMOVAL SCHEDULES ON VARIOUS DIPTERA LARVAE AND SELECTED ANTHROPOD PREDATORS,
California Univ., Berkeley. Dept. of Entomology and Parasitology.
John H. Peck, and John R. Anderson.
Journal of Economic Entomology, Vol 63, No 1, February 1970, p 82-90. 11 fig, 7 ref.

Descriptors: *Farm wastes, *Poultry, *Larvae, *Insect control, *Entomology, Vectors.
Identifiers: *Manure removal, *Diptera larvae, *Arthropod predators, Sampling, Control of flies.

The effects of weekly manure removal, monthly removal, and no removal on populations of fly larvae and slected predators (Acarina: Machrocheles muscaedomesticae Scopoli, Fuscuropods sp. (undescribed), Parasitidae; Coleoptera: Staphylinidae, Histeridaw, Hydrophilidae; Diptera: Ophyra leucostoma (Wiedemann) were studied for a full fly season at each of 2 northern California ranches. Third-instar larvae of the house fly, Musca domestica L., the false stable fly, Muscina stabulans (Fallen), and Calliphoridae were most abundant in 1-week-old manure; those of the little house fly, Fannia canicularis (L.), the coastal fly, Fannia femoralis Stein, and the black garbage fly, O. leucostoma, reached greatest numbers in 2- to 3-week-old manure. Unremoved manure had the least numbers of dipterous larvae, with the exception of the stable fly, Stomoxys calcitrans (L.). All predators studied were most abundant in unremoved manure. Abstention from manure removal favored the predators; monthly or biweekly removal favored the dipterous larvae. (Miner-Iowa State)
W71-00933

GROWTH RATE AS A MEASURE OF PRIMARY PRODUCTIVITY IN BENTHIC ALGAE,
Delaware Univ., Newark. Marine Lab.
Jonathan E. Taylor.
Cheasapeake Science, Vol 10, Nos 3 - 4, p 299-300, Sept.-Dec. 1969. 10 ref.

Descriptors: *Primary production, *Growth rates, Standing crop, Aquatic environment.
Identifiers: Benthic algae, Dry weight.

The rate of primary production is the amount of organic matter produced per unit time. The relation between estimates of growth rates and estimates of primary production is tenuous at best. The most accessible estimates of growth are harvest measurements of changes in the standing crop, but this depends on the destruction of the tissue. Less readily available in situ measurements are changes in linear dimension or surface area of the plant. Both techniques require independent estimates of respiration. (Upadhyaya-Vanderbilt)
W71-00972

THERMALLY INDUCED INTRACELLULAR ALTERATION OF RIBOSOMAL RIBONUCLEIC ACID,
Kansas State Univ., Manhattan.
Leonard J. Rosenthal, and John J. Iandolo.
Journal of Bacteriology, Vol 103, No 3, p 833-835, Sept 1970. 3 fig, 10 ref.

Descriptors: *Thermal pollution, Heat, Cultures, Degradation, Structure, Resistance.
Identifiers: Intracellular, Ribonucleic acid, Thermal pollution effects.

A rapid decay of ribonucleic acid (RNA) has been observed when living cells are exposed to elevated temperature 25C cultures of Staphylococcus aureus were grown and heated. Cell free extracts were prepared by suspending normal and heat treated cells in a lytic mixture. RNA was obtained from the crude extracts and whole cells by a modified phenol-dupanol method. Tritium labeled 23S RNA from heated and control cells was purified by sucrose gradient centrifugation. The control sample contained both 50 and 30S particles, whereas the heat treated preparation was essentially devoid of the 30S unit. Experiments have shown that the degradation of 30S particles varies from 85 to 100 per cent whereas the 50S particles appear intact. Polyacrylamide gel electrophoresis was used to fractionate normal and heated RNA preparations from both crude extracts and whole cells. Both molecular species of RNA were found in the extracts from untreated cells, but in the heated preparation 16S RNA was highly degraded and present only as a very small region. The extent of secondary structural differences in normal and heated 23S RNA was estimated by examining susceptibility to hydrolysis by pancreating ribonuclease. Normal 23S RNA contained 25.2 per cent resistant areas of helical configuration, whereas heated preparation was 16.6 per cent resistant. During heat shock unwinding at 23S RNA occurred. (Upadhyaya-Vanderbilt)
W71-00979

MASTEN V TEXAS CO (POLLUTION OF SUBSURFACE WATERS).
For primary bibliographic entry see Field 06E.
W71-00981

SCHLICHTKRULL V MELLON-POLLOCK OIL CO (ILLNESS CAUSED BY POLLUTION OF WELL).
For primary bibliographic entry see Field 06E.
W71-01028

EFFECTS OF ORGANIC ACIDS ON THE FLOCCULATION OF SUSPENDED SEDIMENTS IN TROPICAL MAN-MADE LAKES,
Ife Univ. (Nigeria).
For primary bibliographic entry see Field 02H.
W71-01062

5D. Waste Treatment Processes

A NOTE ON BACTERIAL GROWTH AROUND A RECHARGE WELL AT BAY PARK, LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 05C.
W71-00579

STUDIES ON LIMESTONE TREATMENT OF ACID MINE DRAINAGE, OPTIMIZATION AND DEVELOPMENT OF IMPROVED CHEMICAL TECHNIQUES FOR THE TREATMENT OF COAL MINE DRAINAGE.
Bituminous Coal Research, Inc., Monroeville, Pa.

Available from NTIS as PB-195 282, $0.95 in microfiche. Also for sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $1.25 SOD 167.13/4 DAST 33. Water Pollution Control Research Series DAST-33, 14010EIZ, 1/70. January, 1970. 96 p, 25 tab, 29 fig, 22 ref. FWQA Program 14010 EIZ, Grant 63-01-68.

Descriptors: *Mine drainage, *Neutralization, *Limestone, Oxidation, *Coal mine water, Iron oxides, Electrophoresis, Activated carbon, Sludge, Coagulation, Waste water.

Identifiers: Ferrous iron, Magnetic sludge.

Four actual coal mine waters have been neutralized with limestone both to a batch scale and by utilizing a continuous flow apparatus. Variations in treatment procedure were necessary depending on the characteristics of the individual waters. A standardized test was established to evaluate the reactivity of the limestone. The following variables are of importance in evaluating limestones for coal mine water neutralization: (a) particle size, (b) Ca and Mg content, and (c) surface area. Ferrous iron oxidation has been accomplished with both synthetic and actual coal mine water at low pH in the presence of coal-derived activated carbon. Electrophoretic mobility studies on procipitates obtained by both lime and limestone neutralization of coal mine water yielded information which can be applied for more effective sludge removal. Magnetic sludges were prepared using two different iron-bearing waters. The conversion of precipitates to a magnetic form results in significant reductions in settled sludge volumes as well as increases in solids content, compared to the initially formed sludge obtained by lime neutralization alone. Data obtained in these studies indicate that the limestone process offers considerable promise for an improved lower cost method for treating several types of coal mine waters.
W71-00620

CONTROLLING DEPOSITS IN COOLING-WATER SYSTEMS,
Nalco Chemical Co., Chicago, Ill.
For primary bibliographic entry see Field 08G.
W71-00642

DESIGN OF CONDENSER COOLING WATER SYSTEM FOR A NUCLEAR POWER PLANT LOCATED ON A LARGE ESTUARY,
Baltimore Gas and Electric Co., Md.; Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; and Worcester Polytechnic Inst., Holden, Mass. Alden Research Lab.
F. J. Jeffers, J. C. Geyer, and L. C. Neale.
Transactions of the ASME, Vol 92, Series A, No 2, April 1970, p 150-156. 5 fig, 3 tab, 8 ref.

Descriptors: *Thermal pollution, *Cooling water, *Nuclear power plant, *Estuaries condensers, Tidal waters, Aquatic life, Solar radiation, Temperature, Model studies, Maryland.
Identifiers: Water quality standards, Chesapeake Bay, Momentum jet, Calvert Cliffs.

Electric generating capacity in the U. S. is continuing to increase at an exponential rate of growth. According to the Federal Power Commission the installed capacity on January 1, 1969, of 290,000 megawatts (MW) may reach 1,000,000 MW by 1990. The sun continuously supplies radiation to the whole earth at a rate of about 174 x 10 to the 9th power MW, which is estimated to be more than 10,000 times mankind's current total rate of fuel energy consumption. The mean monthly surface heat exchange coefficient, K, of the Chesapeake Bay during summer is about 45MW sq mi/F. From this it is estimated that for a temperature rise above ambient 1.5 F over the 3,000 square miles surface of the Bay, exclusive of tributary estuaries, the heat acceptance capacity is 220,000MW of waste heat. This is 64 times the amount of waste heat to be disposed of at Calvert site. Model tests which were carried out to determine the temperature distribution in the vicinity of the plant site and to assist in designing intake and discharge structures which would minimize any local adverse effects are described. Differences in performance of jet releases and low velocity releases as well as shoreline or off shore discharges were fully evident in the test results. (Upadhyaya-Vanderbilt)
W71-00653

HEAT AND MASS TRANSFER IN A CHANNEL WITH SURFACE MASS ADDITION: APPLICATION TO PHASE CHANGE PROCESSES,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 02D.
W71-00655

EARTHQUAKE DESIGN OF COOLING TOWERS,
University of Western Ontario, London. Dept. of Engineering Sciences.
For primary bibliographic entry see Field 08A.
W71-00656

SOME SPECULATIONS ON THE DEVELOPMENT OF NON-BIOLOGICAL METHODS OF SEWAGE TREATMENT,
Water Pollution Research Lab., Stevenage (England).
G. E. Eden.
Effluent and Water Treatment Journal, Vol 10, No 3, p 138-140, 142-146, 1970. 4 tab, 9 ref.

Descriptors: *Sewage treatment, Sludge disposal, Effluents, Coagulation, Sands, Filtration, Suspended load, Solid wastes, Biological treatment, Chemical precipitation, Oxidation, Nitrification, Distillation, Coals, Reverse osmosis, Ammonia, Lime, Aeration, Sulfates, Phosphates, Bicarbonates, Sodium, Potassium, Calcium, Hydrogen ion concentration, Organic compounds.
Identifiers: *Physico-chemical sewage treatment, Borate, Permanganate value, Anionic detergent.

Developments in the field of sewage treatment, indicating a tendency to supplement or replace traditional methods with processes having a closer relation to water treatment and water-reclamation practices, are presented. Recent innovations in sludge conditioning and incineration promise improvement in sludge disposal techniques. The traditional physico-biological procedure will remain the standard method of sewage treatment for major communities but will be improved with better understanding of basic microbiology of the processes. The following methods are suggested: optimization of sewage treatment for reclamation by a combination of high-rate biological treatment with chemical coagulation; treatment of crude sewage, intended primarily to produce an effluent low in phosphorus, first with lime and recycled sludge to precipitate most of the phosphate. Advantages and disadvantages of nonbiological processes for complete treatment of sewage are given in discussion of distillation, treatment of sewage using coal, high temperature oxidation of sewage, and chemical coagulation followed by reverse osmosis. (Jones-Wisconsin)
W71-00669

ELIMINATION OF CHLORAL FROM INDUSTRIAL EFFLUENTS BY ADSORPTION (IN RUSSIAN),
Institut Kolloidnoi Khimii i Khimii Body.
A. M. Koganovskii, and L. N. Gora.
Ukrainskii Khimicheskii Zhurnal, Vol 35, No 4, p 402-404, 1969. 1 fig, 3 tab, 3 ref.

Descriptors: *Industrial effluents, *DDT, *Waste water treatment, Separation techniques.
Identifiers: Charcoal, Chloral.

One of the introduced methods frees industrial effluents from the biologically undecomposable chloral by its adsorption by activated charcoal. Subsequently the charcoal is saturated with sodium hydroxide, a treatment which converts chloral into chloroform and sodium formate. The formate solution is biologically oxidized, whereas chloroform is extracted by water vapor. In the second method, chloral is converted to chloroform and formate by an addition of lime and alkali to the effluent. The latter is then passed through activated charcoal and the regeneration is accomplished by a stream of vapor. The effluent of the plants manufacturing DDT contains from 2 to 30 gallon/liter of chloral, the presence of which precludes biological purification. (Wilde-Wisconsin)
W71-00675

SANITARY SEWERAGE FACILITIES IN UNION COUNTY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 05G.
W71-00786

AN EXPERIMENT ON THE STERILIZATION OF WATER WITH ULTRAVIOLET RAYS,
Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries.
V. I. Laptev.
Trans. from Pishchevaya Promysh. Vol 15, 1967. Available from NTIS as PB-192 870T, $3.00 in paper copy, $0.95 in microfiche. Free Translation March 1970. 4 p.
Identifiers: *Fishes, Industries, *Water, Sterilization, *Parasites, *Ultraviolet radiation, Pest control, Tests, USSR.

For sterilization of the water of cercariae, and also parasitic protozoans, experiments were performed in the laboratory on the effect of ultraviolet rays (UV-rays) on free-living infusoria, parasitic protozoans and non-specific cercariae. First the effect of UV-rays on Chilodonella cyprini, Trichodina sp., Paramecium caudatum, Cercaria sp. in standing water were studied; then several tests with cercariae in flowing water, utilizing the bactericidal apparatus were performed.
W71-00821

WATER AND SEWERAGE STUDY - FIRST PHASE.
Morris County Planning Board, Morristown, N.J.
For primary bibliographic entry see Field 05G.
W71-00831

OIL AND HAZARDOUS MATERIALS CONTINGENCY PLAN FOR PREVENTION, CONTAINMENT AND CLEANUP FOR THE STATE OF MAINE,
Portland Harbor Pollution Abatement Committee, Maine.
For primary bibliographic entry see Field 05G.
W71-00853

CONTINUOUS CATALYTIC DECOMPOSITION OF METHANE,
Battelle Memorial Institute, Columbus, Ohio.
B. C. Kim, J. Zupan, L. Hillenbrand, and J. E. Clifford.
Available from NTIS as NASA CR-1662, $3.00 paper copy, $0.95 in microfiche. National Aeronautics and Space Administration Contract Report NASA CR-1662, October, 1970. 63 p, 1 tab, 26 fig, 5 ref, 2 append. Contract NAS 2-50

Descriptors: *Methane, *Carbon, Oxygen, *Carbon dioxide, Etrolysis.
Identifiers: *Methane decomposition, Methane cracking, Carbon separation, Reactor design.

Experimental studies of catalysts for decomposition of methane and process design studies directed to the problems of carbon production in high-temperature reaction required for a subsystem of the Closed Sabatier system as applied to space life support. The basis for a new reactor design for continuous carbon removal in a gravity independent manner was demonstrated using a rotating magnetic field to support the catalyst in the flowing methane stream and to confine the catalyst bed within the high-temperature reaction zone until a high catalyst utilization is achieved. For this purpose, the preferred catalyst was one power which maintains magnetic properties at the desired reaction temperature of 850 C. On the basis of the experimental data obtained, a methane decomposition reactor having a catalyst volume of about 1 liter was designed for a nominal 3-man system.
W71-00909

'INE HOUSING AND WASTE MANAGE-
NT - A RESEARCH REVIEW,
tional Pork Producers Council; Illinois Univ.,
ana. Coll. of Agriculture.
primary bibliographic entry see Field 05G.
1-00924

NDS STOP POLLUTION FROM FEEDLOTS,
Conservation Service, Salina, Kans.
primary bibliographic entry see Field 05B.
1-00925

BOR-FREE MANURE DISPOSAL,
due Univ., Lafayette, Ind. Dept. of Agricultural
ineering.
Wilmore.
m Journal, Vol 93, No 8, August 1969, p 26C-
. 1 fig.

criptors: *Farm wastes, *Aeration, *Lagoons,
obic bacteria, Effluent, Sprinkler irrigation,
age capacity, Water pollution, Odors, Efficien-
, Slurries, Oxygen, Organic matter, Pumps,
or, Costs, Management.
ntifiers: *Floating aerator, Suspended solids,
atile solids.

earch at Purdue University indicates that a
ting aerator in a lagoon can provide a low cost
em that promises to avoid pollution dangers
saves labor. Manure is dumped into the lagoon
e each day although it is better to have it con-
ously trickle in. Extra water is added to bring
solids content down to 2% or 3% for top effi-
cy. The aerator, a big doughnut-like float with
lectric motor on top driving an impeller, runs
tinuously. The impeller forces a spray of slurry
ver the float, mixing air into the lagoon, so
obic bacteria can break down manure without
rs. Periodically a small pump pulls out some of
mixed slurry and sprinkles it through a 'big gun'
nozzle onto grassland. The irrigation lowers
lagoon, which allows more water dilution and
oves the suspended solids that won't decom-
e. Other advantages include low labor cost as
pared to pits and spreaders, and minimal
agement. Its biggest disadvantage might be
ing the manure into the lagoon each day.
hite-Iowa State)
1-00927

EATMENT OF DAIRY MANURE BY
GOONING,
shington State Univ., Pullman.
nder K. Bhagat, and Donald E. Proctor.
rnal Water Pollution Control Federation, Vol
No 5, 1969, p 785-795. 9 fig, 7 tab, 6 ref.

criptors: *Farm wastes, *Farm lagoons,
odegradation, Algae, Biochemical oxygen de-
d, Anaerobic digestion, Aerobic treatment,
mical oxygen demand, Storage capacity, Ef-
nts, Construction.
ntifiers: *Dairy manure, Total solids, Volitile
ds, Non-degradable solid.

ause of high solids content of dairy manure
e, anaerobic lagoons can be used satisfactorily
primary waste treatment. Average removals of
D, COD, TS, and VS above 86 percent can be
mplished with an applied loading of 70 lb
day/1000 Cu. Ft. (1120 g/day/cu. m.). An
robic lagoon can act as a sedimentation, flota-
, and anaerobic digestion process unit while
ltaneously providing long-term storage for
-degradable solid residue. The effluent from the
robic lagoon retains most of the nutrients
ent in the raw manure waste and thus has fertil-
value. The effluent has organic matter which
be oxidized. The effluent can be applied to a
or subjected to further treatment. The secon-
treatment can be an aerated lagoon, oxidation
h, or an oxidation pond. The results of the
h type aerobic treatment indicated that an ef-
nt BOD at 20 mg/l can be achieved by a 24-hr.
tion period. (Christenbury-Iowa State)
1-00936

NATURAL FILTERS FOR AGRICULTURAL WASTES,
Soil Conservation Service, Washington, D.C.
W. E. Bullard, Jr.
Soil Conservation, Vol 34, No 4, November 1968, p 75-77. 2 fig.

Descriptors: *Farm wastes, *Sprinkler irrigation, *Organic wastes, *Waste water disposal, Air pollution, Water pollution, Odor, Effluents, Sewage effluents, Dilution, Decomposing organic matter, Insects, Mites, Bacteris, Fungi, Algae, Nitrites, Nitrates, Detergents, Phosphates.
Identifiers: *Biologic 'disposers', Microscopic organisms, Papermill waste effluent, Cheese factory waste waters.

Farmers and processors of farm products are finding that the waste products of their operations generally can be returned to the land with less hazard to the environment than when discharged into streams. By completing the natural cycle of growth, death, and decay on the land where crops are produced they make use of a legion of 'disposer' organisms in the soil capable of decomposing organic wastes on site. When sprayed on grass or crops, the effluent serves the dual purpose of irrigating and fertilizing the field, thus, agriculture has the potential means of disposing of its own wastes and preventing or reducing environmental pollution. Numerous examples are given of returning sewage treatment effluents, pulp and papermill effluents, and cheese factory waste waters, among others, to the land by sprinkler irrigation. The principle behind these successful operations is that of getting material produced from the land back onto the land where they can be used again in production. (White-Iowa State)
W71-00940

TREATMENT OF BEEF-CATTLE WASTE WATER FOR POSSIBLE REUSE,
North Dakota State Univ., Fargo.
G. L. Pratt, R. E. Harkness, R. G. Butler, J. L. Parsons, and M. L. Buchanan.
Transactions of the ASAE, Vol 12, No 4, 1969, p 471-473. 2 fig, 3 tab, 19 ref.

Descriptors: *Farm wastes, *Cattle, *Septic tank, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Effluents, Aeration, Dissolved oxygen, Turbidity, Aluminum.
Identifiers: *Settling tank, *Slatted floor, *Reuse, Total solids, Volatile solids, Aluminum sulfate.

Removing solid materials from wastes that have been washed from a livestock barn with water can be accomplished in several ways. In trials at the North Dakota Agricultural Experiment Station settling tanks were evaluated. Treatments of overflow from the settling tank by aeration and chemical coagulation were compared with settling only. The equipment consisted of an 8x8 foot animal shelter with a steel-slatted floor. Manure was washed from under the floor to a settling tank. A secondary treatment tank was installed to receive overflow from the settling tank. A pump end holding tank was used so that the effluent from the secondary treatment tank could be used in washing the floor under the steel slats. Aeration and treatment with alum did not upgrade the waste water sufficiently to make the water odorfree. It was also colored. Other treatment will be needed to remove the odor before the water can be suitable for reuse in washing the building. (White-Iowa State)
W71-00942

STABILITY OF HYPERBOLOIDAL COOLING TOWER,
Uillinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics; and Marley Co., Kansas City, Mo.
For primary bibliographic entry see Field 08A.
W71-00984

5E. Ultimate Disposal of Wastes

NEED FOR SALINE GROUNDWATER DATA TO ADVANCE DESALTING TECHNOLOGY,
Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03A.
W71-00570

DEEP WELL DISPOSAL OF WASTE WATERS IN SALINE AQUIFERS OF SOUTH FLORIDA,
Black, Crow and Eidsness, Inc., Gainesville, Fla.; and Geological Survey, Tallahassee, Fla.
Jose I. Garcia-Bengochea, and Robert O. Vernon.
Water Resources Research, Vol 6, No 5, p 1464-1470, October 1970. 7 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Aquifers, *Injection wells, *Florida, Waste disposal, Industrial wastes, Saline water systems, Limestones, Karst, Confined water, Groundwater movement, Regulation, Water law, Hydrogeology, Monitoring, Sampling, Brines, Acids.
Identifiers: Waste disposal wells.

Florida is underlain by very rich water-bearing strata called the Floridan aquifer. Solution channels and caverns in carbonaceous rocks are found at different depth intervals in extensive, thick (several thousand feet) sections of limestones and dolomites. In south Florida the bottom part of the Floridan aquifer includes extremely cavernous strata, commonly referred to as the 'Boulder Zone.' Chloride concentration in the water of the Boulder Zone is over 2000/mg liter. Because of this, large volumes of brine from oil fields are reinjected into this zone. Since 1966 industrial waste (essentially 1% acetic acid) has been injected into a disposal well drilled to the top of the Boulder Zone southeast of Lake Okeechobee. Planning and monitoring of this well have included the cooperation of government and private interests. Experiences, results, and potential of this zone for further similar uses are discussed. (Knapp-USGS)
W71-00573

WATER SUPPLY AND SEWAGE DISPOSAL.
Rensselaer County Dept. of Planning and Promotion, Troy, N.Y.
For primary bibliographic entry see Field 03D.
W71-00828

ENVIRONMENTAL SIMULATION AS A TOOL IN A MARINE WASTE DISPOSAL STUDY OF JAMAICA BAY,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05G.
W71-00830

RADIOACTIVE WASTE DISPOSAL BY HYDRAULIC FRACTURING,
Oak Ridge National Lab., Tenn.
Wallace de Laguna.
Industrial Water Engineering, Vol 7, No 10, p 32-37, October 1970. 6 p, 4 fig, 9 ref.

Descriptors: *Injection wells, *Radioactive waste disposal, *Fractures (Geology), *Shales, *Grouting, Hydrogeology, Permeability, Cement grouting, Clays, Concretes, Leakage.
Identifiers: Hydraulic fracturing (Underground), Waste disposal wells, Waste injection wells.

Nuclear fuel reprocessing plants produce about 1300 to 5200 gal per day of intermediate waste. This material, and the sludges from the low-level waste treatment, are suitable candidates for disposal by hydraulic fracturing in areas where the geology is favorable for such operations. Waste disposal by hydraulic fracturing requires much the same procedure and equipment as oil-well stimulation. Once rock fracturing and flow down the injection well are established, Portland cement and clay,

and possibly other additives are mixed into the stream of water. The liquid feed is then switched to the radioactive waste, and the waste, also mixed with the proper proportion of solids, is pumped down the well until the waste tanks are empty. The liquid feed is then switched back to water until the remaining solids are all used up, and finally is pumped down the well to flush it and the slot clear of cement. The well is then shut in until the cement has set and the waste-cement-clay mixture converted into a thin layer of artificial rock embedded in depth in the shale. (Knapp-USGS)
W71-00882

LABOR-FREE MANURE DISPOSAL,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W71-00927

CONTROL OF HOUSE FLIES IN SWINE-FINISHING UNITS BY IMPROVED METHODS OF WASTE DISPOSAL,
Purdue Univ., Lafayette, Ind. Dept. of Entomology.
For primary bibliographic entry see Field 05G.
W71-00932

5F. Water Treatment and Quality Alteration

THE FLOTABILITY OF CZECHOSLOVAKIAN ION-EXCHANGE RESINS (IN CZECHOSLOVAKIAN),
Kosice Univ. (Czechoslovakia). Dept. of Chemistry.
Anna Sopkova.
English summary. Chemicke Listy, Vol 63, No 5, p 596-609, 1967. 8 fig, 7 tab, 14 ref.

Descriptors: *Resins, *Ion exchange, *Flotation, *Water treatment, Water conditioning.
Identifiers: Crosslinkage, Copolymers, pK values, Katex, Anex, Thiocarbonates, Alkylsulphates, Czechoslovakia.

The flotability of Czechoslovakian exchange resins (Katex S, Katex KM, Anex S and TM, and Anex S 8D) was compared with that of the foreign products (Dowex, Ira, Permutit, Biorex, SAR, Sar, AG, and AV). The flotability of the resins was observed in hydrogen ions and hydroxide forms, in combination with chlorine and divalent copper, and in a suspension containing 50% solid particles. The results confirmed that the flotability of exchange resins depends upon their hydrophobility and the dissocication of the attached polar groups. The resins of Czechoslovakian production exhibited a fair degree of flotability, but some of them required a higher percentage of copolymers than do resins of foreign origin. (Wilde-Wisconsin)
W71-00679

ELIMINATION OF PETROLEUM REFUSE BY A PRODUCT HARMLESS TO AQUATIC FLORA (IN FRENCH),
Laboratoire de Cryptogamie du MNHN, Paris (France); Bureau de Recherches Geologiques et Minieres, Loiret (France); Institut Oceanographique, Paris (France); Laboratoire Maritime du MNHN, Ille-et-Vilaine (France); Fondation Curie, Paris (France) Laboratoire de Genetique.
Pierre Fusey, Juan Goni, Jean-Claude Lacaze, Marie-Louise Priou, and Jacqueline Lamidey.
Comptes Rendus Academie des Sciences, Paris, Vol 269, No 24, Serie D, p 2435-2438, 1969. 3 fig, 5 ref.

Descriptors: *Emulsifiers, *Oil wastes, *Dispersion, Water pollution control, Sea water, Toxicity, Laboratory tests.
Identifiers: Oil spills, Hydrocarbons, Petroleum wastes.

An unidentified commercial product, composed of carbohydrates (saccharose and glucose) and phosphoric acid was tested as an emulsifier and disperser of petroleum in water. The compound has a specific gravity of 1.596. It is introduced to petroleum spills by simple mechanical dispersion, is suitable for all waters, and remains stable in pH range of 1.8-8.0. It is 62 times less toxic than the products used since the Torrey Canyon oil spill. It has slight effect on micro-communities of marine algae in application below 0.05 cubic centimeter/liter; cultured marine ecosystems showed no effects in media containing pollutant and 0.04 cubic centimeter/liter of the compound. Marine fish displayed no apparent detrimental effects after 6-hour exposure of 0.12 cubic centimeter/liter of the product. Shrimp tolerated concentrations of 0.30 cubic centimeter/liter; mussels were unable to tolerate concentrations above 0.12 cubic centimeter/liter. These concentrations exceeded requirements for dispersion and emulsification of petroleum. Laboratory mammals showed no deleterious effects. Comparison of chromatograms after 3 months at laboratory temperature indicated that petroleum disappeared almost entirely from solution. The problems of residual sludge of sea transport, beach pollution and harbor installations may be overcome by this compound. (Auen-Wisconsin)
W71-00681

HUMAN WASTE SANITATION STUDIES,
Truesdail Labs., Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 05G.
W71-00814

AN EXPERIMENT ON THE STERILIZATION OF WATER WITH ULTRAVIOLET RAYS,
Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries.
For primary bibliographic entry see Field 05D.
W71-00821

WATER AND SEWERAGE STUDY - FIRST PHASE.
Morris County Planning Board, Morristown, N.J.
For primary bibliographic entry see Field 05G.
W71-00831

PRELIMINARY EVALUATION OF AVAILABILITY OF POTABLE WATER ON ELLIOTT KEY, DADE COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 03B.
W71-00881

5G. Water Quality Control

STORM WATER POLLUTION FROM URBAN LAND ACTIVITY, DEVELOPMENT OF ANALYTICAL PROCEDURES FOR PREDICTING STORM WATER POLLUTION FROM URBAN AREAS BY USE OF SELECTIVELY DEFINED URBAN CHARACTERISTICS.
Avco Economic Systems Corp., Washington, D.C.
For primary bibliographic entry see Field 05A.
W71-00619

STUDIES ON LIMESTONE TREATMENT OF ACID MINE DRAINAGE, OPTIMIZATION AND DEVELOPMENT OF IMPROVED CHEMICAL TECHNIQUES FOR THE TREATMENT OF COAL MINE DRAINAGE.
Bituminous Coal Research, Inc., Monroeville, Pa.
For primary bibliographic entry see Field 05D.
W71-00620

DYNAMIC MODEL STUDY OF LAKE ERIE, PART I. SIMILITUDE CRITERIA AND EXPERIMENTAL SET-UP,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
For primary bibliographic entry see Field 02H.
W71-00621

DYNAMIC MODEL STUDY OF LAKE ERIE, PART II, ANALYTICAL AND EXPERIMENTAL RESULTS,
State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
For primary bibliographic entry see Field 02H.
W71-00622

FEASIBILITY OF A PERIODIC FLUSHING SYSTEM FOR COMBINED SEWER CLEANSING.
FMC Corp., Santa Clara, Calif. Central Engineering Labs.

Available from the NTIS as PB-195 223, $3.00 in paper copy, $0.95 in microfiche. Final Report - Phase I, CE45363, August, 1967. 48 p, 1 tab, 11 fig, 23 ref, 4 drawings. FWQA Program 11020DJ NO08/67.

Descriptors: Sewers, Overflow, Conveyance structures, Storm drains, Water pollution control, Costs, Flow.
Identifiers: *Combined sewers, *Storm water overflow, *Flushing systems, *Sewer flushing, Sewer cleansing.

One of the causes of pollution from stormwater overflow of combined sewers is the deposition of pollutional solids during dry weather flow followed by pick up of the pollutional material during storm flow when the flow be bypassed. As a solution to this problem, it has been proposed that a flushing system be used to periodically cleanse the sewer during dry weather and convey the solids to the treatment plant. Under Phase I a study was made of sewer flushing practices, application requirements and hydraulic theory. Investigation was also made of sampling methods and equipment; flushing test equipment was designed for use in Phase II, and the cost of Phase II was estimated. It was confirmed that additional detailed information is needed to apply a periodic flushing system to actual combined sewers. It was also concluded that the existing information on sewer flushing indicated a good possibility that a periodic flushing system would be feasible for reducing pollution from combined sewer stormwater overflow. The detailed information needed to apply a sewer flushing system must be determined by a large number of controlled experiments of flushing effectiveness. The design of flushing evaluation equipment for use in Phase II has been carried to the point that cost estimates can be made for construction of the equipment. A description of the design and the cost estimates are included in this report.
W71-00623

STREAM POLLUTION IN THE 'NEW LE BELT' OF S.E. MISSOURI,
Missouri Water Resources Research Cen Columbia.
For primary bibliographic entry see Field 05C.
W71-00627

ARTIFICIAL MIXING OF STRATIFIED FLU FORMED BY SALT AND HEAT IN A LABO TORY RESERVOIR,
Rutgers - The State Univ., New Brunswick, Water Resources Research Inst.
Lucien M. Brush, Jr.
Available from NTIS as PB-195 308, $3.0 paper copy, $0.95 in microfiche. New Jersey W Resources Research Institute, Rutgers Univer New Brunswick, Sept. 1970. 37 p, 2 tab, 7 fig ref, append. OWRR Project B-024-NJ (1).

Descriptors: *Lakes, *Mixing, *Water qu *Stratification, Reservoirs, Thermal profile Density stratification, Water temperature.
Identifiers: *Destratification, Interfacial ent ment.

estratification of a two-layer reservoir by pumpg fluid from one layer and jetting the discharge to the other was studied in the laboratory. The uid layers were formed by hotwater - coldwater d saltwater - freshwater combinations. For a parcular range of Richardson no., thermally stratified uids mixed more readily than those formed by line solutions indicating a greater interfacial enainment rate. Although these differences may be fluenced by molecular diffusivity as suggested by urner, it is felt that there is at least one alternate planation involving local viscous effects near the terface. The results of the study show agreement ith previous laboratory investigations involving fferent geometric arrangements, and with two eld studies of mixing in thermally stratified lakes. sufficient field evidence exists for establishing recise model-prototype relationships, but the verwhelming dominance of the Richardson no. r densiometric Froude no.) as a dynamic control evident. (Whipple-Rutgers)
71-00632

OWELL V CITY OF DOTHAN (ABATEMENT F NUISANCE CAUSED BY MUNICIPAL ASTES).
r primary bibliographic entry see Field 06E.
71-00638

ROCEEDINGS, CONFERENCE (ON) POLLUION OF LAKE SUPERIOR AND ITS TRIBUTAY BASIN, MINNESOTA-WISCONSINICHIGAN, DULUTH, MAY 13-15, 1969; EXCUTIVE SESSION SEPTEMBER 30-OCTOBER

ederal Water Pollution Control Administration.

1970), 4 volumes,

escriptors: *Water quality, *Water quality conol, *Legislation, *Lake Superior, *Administraon, Minnesota, Wisconsin, Michigan, Water polution sources, Water pollution control, Water polution effects, Water policy, Commercial fishing, utrophication, Standards, Population, Water tilization, Legal aspects, Water law, Land use, conomics, Surveys, Public health, Mine wastes, ecreation wastes, Municipal wastes, Industrial astes, Waste treatment.
dentifiers: *Hearings, Waterborne commerce.

learings and testimony, analyses, and evaluations y federal, state, and local agencies, industries, and itizen groups were held in connection with the ollution of Lake Superior and its interstate tributary basin. The effects of taconite tailings, treated nd untreated municipal and industrial wastes, vatercraft, and oil discharges on the lake's ecology vere documented. Reports of bacterial pollution in he St Louis River, Duluth Harbor and Superior Harbor areas, Ashland inshore reaches, and the Montreal River (Wisconsin) are presented. Among he many problems discussed were land use pracices, continued surveillance of taconite tailings lischarges, secondary biological waste treatment y all municipalities, continuous disinfection of reatment plant effluents, phosphorus reduction by 0%, unified collection systems serving contiguous rban areas, prohibition of combined sewers, lischarge of treatable industrial wastes to muicipal systems, and usage of low pesticide concenrations. (Auen-Wisconsin)
W71-00643

CANALS OFFER VAST COOLING POTENTIAL.

Environmental Science and Technology, Vol 4, No 4, April 1970.

Descriptors: Thermal pollution, Cooling water, Temperature, Evaporation, Recreation, Thermal capacity.
Identifiers: Cooling canals, Heat sink.

The principal objective of the canal lake system is provision of an extended heat sink away from the public water courses, capable of supporting power stations all along its route, with reuse of the water as many times as practical. Many of the locations in the U. S. have the potential for such development. To illustrate the potential of canal lake cooling systems, researchers have applied the concept to one of the routes suggested for a major diversion project in the northwest. This proposed 990 mile diversion would begin in Oregon, pass through northwestern California and Nevada via a series of natural lakes and man-made canals, and eventually discharge into Lake Mead. The thermal capacity of this system could support up to 30,000 Mw of generating capacity. Restraints on the system are the following: No temperature rise greater than 5C and surface temperature no higher than 32C at any point. System would also provide recreational facilities to water short areas without distracting from the basic purpose of the system. (Upadhyaya-Vanderbilt)
W71-00659

AMITROLE RESIDUES AND RATE OF DISSIPATION IN IRRIGATION WATER,
Agricultural Research Service, Denver, Colo. Crops Research Div.; and Agricultural Research Service, Prosser, Wash. Crops Research Div.
For primary bibliographic entry see Field 03F.
W71-00698

SYSTEMS APPROACH TO THE EVALUATION OF BENEFITS FROM IMPROVED GREAT LAKES WATER QUALITY,
Illinois Univ., Urbana. Dept. of Civil Engineering.
D. D. Meredith, and B. B. Ewing.
Proc 12th Conf Great Lakes Res, Internat Assoc Great Lakes Res, Braun-Brunfield, Inc, Ann Arbor, Mich, p 843-870, 1969. 28 p, 8 fig, 2 append, 29 ref.

Descriptors: *Systems analysis, *Benefit-cost analysis, *Water quality control, *Mathematical models, *Great Lakes, *Evaluation, Pollution abatement.

A systems approach to the evaluation of benefits that would accrue due to an improvement in the water quality of the Great Lakes due to pollution abatement practices was outlined. Data pertaining to the problem was gathered and a review of literature on water resources benefit evaluation was made. The basic approach for analysis of municipal and industrial water supply, recreational use, and commercial fishing involved following a change in water quality through a sequence of interrelationships to arrive at an estimate of annual benefits. The five steps to a systems analysis approach were given and a mathematical model which could be solved to determine the benefits for a change in water quality when the level of water quality before and after improvement is known was presented in the appendix. This conceptual model for benefit-cost analysis divided a lake into a number of sectors in which strong water quality interrelationships existed and water quality was influenced more by what occurred in the sector than by neighboring sectors. Sectors were defined by major water uses and water quality variables were listed. The model was said to be applicable to all uses. (Kriss-Cornell)
W71-00707

POLLUTION, PURIFICATION AND THE THEORY OF EXTERNAL EFFECTS,
Stockholm Univ., Sweden.
For primary bibliographic entry see Field 06C.
W71-00752

SANITARY SEWERAGE FACILITIES IN UNION COUNTY.
Union County Planning Board, N.J.

Available from NTIS as PB-192 835, $3.00 in paper copy, $0.95 in microfiche. April 30, 1969. 66 p.

Identifiers: *Management planning, New Jersey, *Sanitary engineering, Sewage, Test facilities, Wastes (Industrial), Collecting methods, Structures, Fluid flow, Construction, Storage, Chemicals, Diagrams, Maps, Statistical data, Costs, Effectiveness, *Union County (NJ), Area planning and development, *Sewage facilities.

Union County, like most of the more densely developed and populated counties in northeast New Jersey, has been provided with large, comprehensive regional collection and treatment systems. These regional facilities were created in the past by the municipalities who had the foresight and who were endeavoring to seek the most efficient, effective and economical method of collection treatment. A brief history of the development of sanitary sewer facilities in the County will illustrate how regionalization occurred.
W71-00786

AREAWIDE WATER AND SEWER PLAN: COMPREHENSIVE PLANNING STUDY, CROSSETT, ARKANSAS.
Crossett Ashley County Joint Planning Commission, Ark.

Available from NTIS as PB-193 516, $3.00 in paper copy, $0.95 in microfiche. June 1970. 20 p. HUD Project ARK P-84.
Identifiers: *Sewage, Disposal, *Sanitary engineering, Arkansas, Drainage, Costs, Water supplies, Population, *Area planning and development, *Crossett (Ark), *Sewers, Sewage treatment facilities.

The purpose of the report is to plan for future water and sewer needs for the urban area of the City of Crossett, Arkansas. The plan is based on projected growths for 5-year and 25-year programs.
W71-00788

SEWER AND WATER FACILITIES ANALYSIS.
Capital District Regional Planning Commission, Albany, N.Y.

Available from NTIS as PB-193 332, $3.00 in paper copy, $0.95 in microfiche. July 1970. 45 p. HUD Project NYP 184.
Identifiers: *Management planning, Water supplies, Statistical analysis, *Sanitary engineering, *New York, Rural areas, Sewage, Site selection, Dams, Wastes (Sanitary engineering), Disposal, Tables, Maps, Area planning and development.

Inventory and analysis of both existing and planned public water systems and sewerage systems in the four-county region. The adequacy of water supply and sewerage planning in each county to qualify for initial HUD certification has been evaluated. Additional planning considerations are pointed out if the planning in any area is not adequate. Maps are developed to show the locations of existing and planned water and sewer facilities and the service area of each system. Pertinent data of each system are also collected and summarized in tables.
W71-00790

RICHMOND REGIONAL SEWERAGE PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.

Available from NTIS as PB-192 438, $3.00 in paper copy, $0.95 in microfiche. April 1970, 15 p, tab, fig.
Identifiers: *Urban areas, Sanitary engineering, *Sewerage, *Management planning, Data, Fluid flow, Volume, Pipes, Design, Disposal, Virginia, *Regional planning and development, Richmond, Virginia, Sewage pipes, *Sewerage disposal, Sewerage treatment.

The volume consists of tabulated sewage flows by demand zones and other supplementary technical data pertinent to the basic report.

W71-00805

DU PONT PLANTS EFFLUENT DISPERSION IN DELAWARE RIVER: HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 05G.
W71-00813

DU PONT PLANTS EFFLUENT DISPERSION IN DELAWARE RIVER: HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Available from NTIS as AD-706 216, $3.00 in paper copy, $0.95 in michrofiche. May 1957. 19 p, plates, illus, tabs. Miscellaneous Paper No. 2-222.
Identifiers: *Power plants (Establishments), Water pollution, *Water pollution, Hydraulic models, Floods, Wastes (Industrial), Scattering, River currents, Tides, Rivers, Delaware. Delaware River.

Deepwater Point and Carneys Point Plants of the du Pont Company, located on the New Jersey shore of the Delaware River are presently discharging high-acidity, high-density by-products from two retention basins through tide-controlled sluice gates into the Delaware River. The sluice gates open during times of ebbing currents and close during times of flooding currents. Currents adjacent to the shore line in the vicinity of the discharge points are low, and the plant effluents are not being rapidly and efficiently dispersed throughout the river water passing the plants. Effluent concentrations in all small embayments and pockets along the New Jersey shore are at time higher in the vicinity of the plants than elsewhere along the shore line. To alleviate this situation it was proposed that the present method of releasing effluent intermittently through the two tidal sluice gates be changed to a continuous release method utilizing pipes extending into the river along the channel bottom.
W71-00813

HUMAN WASTE SANITATION STUDIES,
Truesdail Labs., Inc., Los Angeles, Calif.
Clyde L. Blohm.
Available from NTIS as AD-706 931, $3.00 in paper copy, $0.95 in microfiche. Final Report, May 1965. 44 p. OCD-DS-63-235.
Identifiers: *Fallout shelters, *Wastes (Sanitary Engineering), Odors, Control, Sodium compounds, Sulfates, Copper compounds, Oleic acids, Mineral oils, Chemicals, Costs, *Odor control, Copper sulfates, Sodium bisulfate.

Investigations were made of the handling and storage of human wastes as they might be encountered under occupancy conditions in Office of Civil Defense fallout shelters. A chemical sanitizing and odor control agent has been selected from a number tested. This preferred agent is a simple physical mixture of two parts sodium bisulfate and one part copper sulfate pentahydrate, used in the waste container at the concentration of one pound per ten gallons (12,000 ppm) of accumulated wastes. One pint of oleic acid (commercial red oil) may or may not be used as a vapor barrier to improve odor control. General criteria have been established for the specification of such control agents which may be other than the one selected. Design studies were conducted for the fabrication of a Sanitary Vault intended for use in fallout shelters. The vault is equipped with two seats and has a useable fill volume of 70 gallons of mixed wastes. Four prototype units were constructed for testing. Recommendations for further work have been made.
W71-00814

RECOMMENDED REGIONAL PLAN FOR SEWERAGE, WATER SUPPLY AND STORM DRAINAGE.
Valley Regional Planning Agency, Ansonia, Conn.
For primary bibliographic entry see Field 06B.
W71-00819

STORM DRAINAGE: INVENTORY AND ANALYSIS OF MAJOR EXISTING AND PLANNED FACILITIES. VOLUME V: STORM DRAINAGE.
Valley Regional Planning Agency, Ansonia, Conn.
For primary bibliographic entry see Field 06B.
W71-00820

WATER SUPPLIES AND WATER FACILITIES IN UNION COUNTY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 03D.
W71-00826

WATER SUPPLY AND SEWAGE DISPOSAL.
Rensselaer County Dept. of Planning and Promotion, Troy, N.Y.
For primary bibliographic entry see Field 03D.
W71-00828

MANAGING THE NATURAL ENVIRONMENT: A REGIONAL PLAN FOR WATER, SEWAGE, AIR AND REFUSE,
Tri-State Transportation Commission, New York.
Richard S. DeTurk.
Available from NTIS as PB-190 290, $3.00 in paper copy, $0.95 in microfiche. March 1970. 38 p. HUD Project INT P-221.
Identifiers: *Water pollution, Control, *Air pollution, Environment, Sewage, Wastes (Sanitary Engineering), Wastes (Industrial), Water supplies, Passenger vehicles, Generators, Heaters, Incinerators, Connecticut, Sea water, Purification, Desalination, Costs, Urban areas, New Jersey, New York, Sources.

The Tri-State Region Connecticut, New Jersey, New York, should invest $9.7 billion between now and 1985 to contend with its environmental problems: lack of water, dirty air, polluted streams and overflowing garbage dumps. For more water the Region should tap more sources in the countryside and make better connections between neighboring water-supply systems. For cleaner waterways, vast spending for sewage-treatment plants is required to treat industrial and residential wastes. This will require federal assistance beyond what has been offered in the past. For cleaner air, the Region needs further tightening of pollution controls to counteract increasing numbers of polluters: motor vehicles, home heating units, generating stations and incinerators. And refuse disposal requires a changeover from dumping and burying to high-grade incineration. A network of 70 to 80 incinerators should be planned and built. Other methods for gathering water, such as desalinating sea water, purifying and reusing sewer water, and damming Long Island Sound or the Hudson River, are not appropriate at this time. Also, the Region cannot count on the appearance of electrically powered autos to stem air pollution, nor can enough remote areas be found to accept massive amounts of hauled garbage from developed areas. But tests should be encouraged to develop advanced technology, such as compacting and hauling refuse to remote areas or recycling sewage effluent or finding new uses for many solid wastes.
W71-00829

ENVIRONMENTAL SIMULATION AS A TOOL IN A MARINE WASTE DISPOSAL STUDY OF JAMAICA BAY,
Rand Corp., Santa Monica, Calif.
J. J. Leendertse.
Available from NTIS as AD-703 388, $3.00 in paper copy, $0.95 in microfiche. March 1970. 9 p. P-4163.
Identifiers: *Water pollution, *Estuaries, *Wastes (Sanitary engineering), Simulation, Mathematical models, New York, Fluid flow, Predictions, Transport properties, Models (Simulations), Temperature, *Waste water, Jamaica Bay (New York).

The study of technical solutions to the problem of managing fluid waste discharges in an estuary involves complicated relationships, such as those between the waste load, the location of discharges, the degree of treatment, the geometry of the estuary, the flow in the estuary, and the temperature. Models can be built to predict the probable consequences of each of the alternative solutions chosen. Using the predictions obtained from these models and whatever other information or insight is relevant, alternatives can be compared and conclusions drawn concerning the most desirable course of action. Such a model for well-mixed estuaries and coastal seas is presented and described.
W71-00830

WATER AND SEWERAGE STUDY - FIRST PHASE.
Morris County Planning Board, Morristown, N.J.

Available from NTIS as PB-192 790, $3.00 in paper copy, $0.95 in microfiche. May 1969, 89 p, plates, tabs. HUD P-97.
Identifiers: *Water supplies, New Jersey, *Sanitary engineering, *Sewage, Disposal, Statistical analysis, Rivers, Population, Consumption, Water pollution, *Regional planning and development, *Morris County (New Jersey), *Sewers, Waste water, Waste treatment plants.

The study includes an inventory of existing water and sewerage facilities within Morris County. Analysis of present water consumption and projected population indicates the need for developing additional water supplies on a long-term basis. Future demands of the individual municipalities will exceed the capacity which in many instances can be developed on an individual basis. The low-flow conditions in the streams and the volume of waste water from individual sewage treatment plants, particularly in the Passaic watershed, indicates the need for improved treatment methods in order to meet the stream quality criteria recently established by the New Jersey State Department of Health. Although the average flows in the streams of the County are sufficient to provide adequate dilution for the present volume of waste water discharged, there are times during the summer and fall months when dilution ratios of less than 1 to 1 are available for assimilating the pollutants discharged by the many waste treatment plants located on a stream. A review of available data on the water quality of the stream indicates that the mineral characteristics are such that the waters are suitable as a source of raw water supply with the required degree of treatment dependent upon flow conditions at specific times. Particularly as regards the Passaic watershed, high coliform count and low dissolved oxygen at times preclude the safe use of the majority of the streams for water contact sports such as swimming or the propogation of game fish.
W71-00831

WATER POLLUTION CONTROL CREATES DEMAND FOR GROUNDWATER HYDROLOGISTS,
Geological Survey, Denver, Colo. Water Resources Div.
E. A. Moulder.
Mining Engineering, p 90-91, February 1970. 2 p, 1 fig.

Descriptors: *Water pollution control, *Groundwater, *Water supply, Water pollution sources, Industrial wastes, Mine wastes, Acids, Dewatering, Desalination, Leaching, Chemical analysis, Analytical techniques.
Identifiers: *Groundwater hydrology.

The mining industry is continually faced with problems involving dewatering, pollution, water supply, leaching and hydrochemical mining and prospecting. Greater application of the principles of groundwater hydrology to solution of these problems promises improved operating efficiency, increased safety and better public relations. Estimating the magnitude of dewatering for a proposed

nine may be a major factor in determining the easibility of proceeding with mine development. Diverting the source of groundwater to an aban-doned mine may save costly treatment of acid nine-drainage. Development of a large ground-vater supply near an ore deposit may enhance the ossibilities of a leaching operation. Detection of ertain dissolved minerals in water from springs or vells may lead to hitherto unknown mineral leposits. Current efforts of industry, educational nstitutions and government are making these kind f events more commonplace. (Woodard-USGS)
V71-00848

USQUEHANNA RIVER BASIN STUDY--A REVIEW.
Susquehanna River Basin Study Coordinating Committee, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W71-00852

OIL AND HAZARDOUS MATERIALS CONTINGENCY PLAN FOR PREVENTION, CONTAINMENT AND CLEANUP FOR THE STATE OF MAINE,
Portland Harbor Pollution Abatement Committee, Maine.
Edward Langlois.
Portland Harbor Pollution Abatement Committee, January 1970. 35 p, 1 map.

Descriptors: *Oily water, *Maine, *Maine pollution control, *Water pollution treatment, Governments, Water law.
Identifiers: Oil spill treatment.

The purpose of this contingency plan is to provide information and recommendations regarding possible oil or other hazardous material spills along the coast or the waterways of Maine to elected and appointed officials and community leaders in municipalities exposed to this danger. This basic information should enable individual municipalities to organize personnel and equipment ot prevent spills and to contain or remove them if a spill does occur. Information is provided to local municipalities regarding the availability of additional help from state and federal agencies. (Knapp-USGS)
W71-00853

RADIOACTIVE WASTE DISCHARGES TO THE ENVIRONMENT FROM NUCLEAR POWER FACILITIES,
Bureau of Radiological Health, Rockville, Md.
For primary bibliographic entry see Field 05B.
W71-00856

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
Donald M. Marske.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C, 20402 - $2.50. In: Combined Sewer Overflow Abatement Technology, Water Pollution Control Research Series 11024 - 06/70, p 57-106, June 1970. 50 p, 13 fig, 6 tab, 2 ref.FWQA Contract 14-12-128.

Descriptors: *Storm runoff, *Storm drains, *Sewers, *Overflow, *Water pollution, Chemical analysis, Research, Screens, Model studies, Water pollution control.
Identifiers: *Combined sewer overflows, *Portland (Oreg).

The objective of this study was to determine the feasibility, effectiveness, and economics of employing high-rate, fine-mesh screening for primary treatment of storm water overflow from combined sewer systems. The final form of the screening unit stands 63 inches high and has an outside diameter of 80 inches. The unit is fed by an 8-inch pipe carrying 1700 gpm (122 gal/min/sq ft) which is distributed to a 60-inch diameter rotating (60rpm) stainless steel collar screen having 14 square feet of available screen area and a 165 mesh (105 micron opening, 47.1 percent open area). The screen is backwashed at the rate of 0.235 gallons of backwash water per 1000 gallons of applied sewage. Based on final performance tests run on dry-weather sewage, the unit is capable of 99 percent removal of floatable and settleable solids, 34 percent removal of total suspended solids and 27 percent removal of COD. The screened effluent is typically 92 percent of the influent flow. (See also W70-09558) (Woodard-USGS)
W71-00872

SEWER MONITORING AND REMOTE CONTROL-DETROIT.
Detroit Metro Water Services, Mich.

For sale by the Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $2.50. In: Combined Sewer Overflow Abatement Technology, Water Pollution Control Research Series 11024 - 06/70, p 219-290, June 1970. 72 p, 33 fig, 4 tab, append. FWQA Project 11020 FAX.

Descriptors: *Storm drains, *Sewers, *Overflow, *Water pollution control, Water quality, Monitoring, Remote control, Rain gages, Systems analysis.
Identifiers: *Combined sewer overflows, Storm flow anticipation, First flush interception, Selective retentions, Selective overflowing, Detroit (Mich).

Detroit is faced with the problem of preventing pollution of the Detroit and Rouge Rivers from its combined sewer system overflows. As an alternative to undertaking a dubiously effective sewer separation program, estimated to cost in excess of two billion dollars, the Detroit Metro Water Department has installed the nucleus of a sewer monitoring and remote control 'system' for controlling the pollution from the combined overflow from many small storms at a cost of slightly over two million dollars. The 'system' includes telemetering rain gages, sewer level sensors, overflow detectors, a centrally located computer and data-logger, and a centrally located operating console for controlling pumping stations and selected regulating gates. Installation has been virtually completed and now enables applying such pollution control techniques as 'storm flow anticipation', 'first flush interception', 'selective retention', and 'selective overflowing'. An evaluation of the effectiveness of this initial installation will serve as the basis for determining what additional pollution control facilities are required. (See also W70-09558) (Woodard-USGS)
W71-00876

ORGANIZING FOR SOIL EROSION AND SEDIMENT CONTROL IN OUR NATIONS URBAN AREAS,
National Association of Counties Research Foundation, Washington, D.C.
Mel D. Powell.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $2.50. In: Combined Sewer Overflow Abatement Technology, Water Pollution Control Research Series 11024 - 06/70, p 321-336, June 1970. 16 p. FWQA Program 15030 DTL.

Descriptors: *Sediment control, *Erosion control, Urbanization, Road construction, Sewers, Storm drains, Overflow, Storm runoff, Planning, Abatement, Control systems.
Identifiers: *Guide book, *Policy making, Organization for control.

Some considerations involved in organizing an erosion and sediment control program along with some specific organizational structures that may be suitable, with modifications, to a variety of local situations are discussed. The Federal Water Quality Administration awarded the National Association of Counties Research Foundation a grant to investigate the problem of sedimentation and to develop a guidebook for local policy making officials. Chapter 10 entitled 'Action Guide for Erosion and Sediment Control' from the guidebook published in March 1970 is included in this report. The chapter represents a synthesis of sedimentation control concepts, principles, and techniques, which can be converted into general action plans by local, state, and federal levels of government. (See also W70-09558) (Woodard-USGS)
W71-00877

QUANTITATIVE ANALYSIS OF INDUSTRIAL WATER-USE PATTERNS IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 06D.
W71-00902

APPROXIMATE HYDRAULIC MODELLING OF STRATIFIED FLOWS IN COOLING PONDS,
A. G. Averkiev, K. Ya. Kind, and I. I. Makarov.
13th Congress of the International Association for Hydraulic Research, August 31-September 5, 1969, Broc. Vol I, Subject A, p 99-103.

Descriptors: Stratified flow, Hydraulic models, *Thermal powerplants, Froude number, Temperature, *Heat balance.
Identifiers: *Cooling Ponds.

An approximate method of modelling and designing the cooling capacity of ponds for thermal power plants taking into account the occurrence of stratified flows in the cooling pond is given. The method is based on experimental findings obtained on large scale hydrothermal models, on field investigation and on scaling of hydrothermal research data to prototype conditions using digital computers. It is shown that heat loss to the atmosphere of thermal jets will be less by two orders of magnitude than the lateral heat transfer. Equations are derived for the case when the warm jet entering a cold reservoir spreads in it causing a two layer motion, the density of each layer being assumed constant across the depth. The heat balance equations for the entire reservoir is solved to define the intake water temperature. The intake cool water temperature for a number of cooling ponds of actual thermal plants was determined by the contours of prototype isotherms and the relations adopted for calculation of heat loss coefficient. Calculation results are in satisfactory agreement with corresponding observed values of the cool water temperature. (Upadhyaya-Vanderbilt)
W71-00918

EFFECTS OF ABATEMENT OF DOMESTIC SEWAGE POLLUTION ON THE BENTHOS, VOLUMES OF ZOOPLANKTON, AND THE FOULING ORGANISMS OF BISCAYNE BAY, FLORIDA,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 05C.
W71-00919

SWINE HOUSING AND WASTE MANAGEMENT - A RESEARCH REVIEW,
National Pork Producers Council; Illinois Univ., Urbana. Coll. of Agriculture.
Arthur J. Muehling.
Department of Agricultural Engineering, College of Agriculture, University of Illinois at Urbana-Champaign, August 1969. 91 p, 232 ref. A. Eng.-873.

Descriptors: *Farm wastes, *Hogs, *Confinement pens, *Aerobic treatment, *Anerobic digestion, Odor, Economics.
Identifiers: *Oxidation ditch, *Housing, Space requirements, Slotted floors, Methods of disposal, Legal implications.

Current and past research in swine housing and waste management is reviewed and summarized. The author utilized 77 references in Part I of the report on swine housing studies. Research on production units, space requirements, slotted floors, and economics of swine housing systems is presented in summary form. Recommendations for future swine housing research are made. 155 references were utilized in Part II of the report on waste management studies. Properties of swine wastes, treatment and return of swine wastes to the land, other methods of disposal, gases and odors, and legal implications of waste handling are summarized. Recommendations for future research in waste management are made. Six fact sheets available from the National Pork Producers Council, Des Moines, supplement the research review. (White-Iowa State)
W71-00924

CONTROL OF HOUSE FLIES IN SWINE-FINISHING UNITS BY IMPROVED METHODS OF WASTE DISPOSAL,
Purdue Univ., Lafayette, Ind. Dept. of Entomology.
R. C. Dobson, and F. W. Kutz.
Journal of Economic Entomology, Vol 63, No 1, February 1970. 6 fig, 3 ref.

Descriptors: *Farm wastes, *Hogs, Disposal, Lagoons, *Insect control, Vectors, Entomology.
Identifiers: *Control of house flies, *Waste disposal systems, Collection pit, Slotted floor.

Four swine-finishing units were equipped with different waste disposal systems to determine their effectiveness in preventing development of the house fly, Musca domestica L. Each unit was completely screened to prevent contamination from outside sources. No insecticides were used. One of the 4 was a standard shed-type house used as a control. The other 3 units were equipped with new and improved waste disposal systems. Results from 2 years of study indicate that house fly production in and around swine-finishing units can be greatly reduced by using 1 of the 3 improved methods of waste disposal described. (Miner-Iowa State)
W71-00932

INFLUENCE OF SPACE ON PERFORMANCE OF FEEDLOT CATTLE,
California Univ., Davis; and Agricultural Research Service, Davis, Calif.
S. R. Morrison, V. E. Mendel, and T. E. Bond.
Transactions of the ASAE, Vol 13, No 1, January 1970, p 145-147. 2 fig, 2 tab, 9 ref.

Descriptors: *Farm wastes, *Cattle, *Performance, *Confinement pens.
Identifiers: *Space, *Influence, *Weight gain, Feed efficiency.

Two tests in the Imperial Valley of California involving 74 heifers indicate that space allotments below 40 sq. ft. per head are likely to reduce the body weight gains and feed efficiency of feedlot cattle, and hot weather may accentuate the decrease. There is evidence suggesting that animal performance may be less even at 40 sq. ft. than at 60 sq. ft. per head. Tests with larger pens and more animals are desirable to establish the relation between gain and feed efficiency and pen space per animal. The range of space tested should be great enough to provide sufficient data to aid in designing feed lots for maximum profit. (White-Iowa State)
W71-00934

WATER POLLUTION CONTROL LEGISLATION,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
Condensation of report NA68-304 available from ASRE, St. Joseph, Mich. 49085, $0.50. Agricultural Engineering, Vol 50, August 1969, p 468-470. 8 ref.

Descriptors: *Farm wastes, *Water pollution, *Legislation, Water pollution control, Water Quality Act, Biochemical oxygen demand, Phosphates, Effluents.
Identifiers: *Treatment processes, Aerobic oxidation pond, Aerated lagoon, Oxidation ditch, Minimum removal efficiencies, Water quality criteria.

Agricultural production facilities must consider waste disposal as an important aspect of their operations. Waste treatment and disposal facilities are becoming important parts of agricultural production facilities. They must be evaluated whenever expansion or establishment of new facilities is underway. Highly efficient secondary treatment processes perhaps including nutrient removal and disinfection may be necessary for discharging waste waters to surface waters. The need for and cost of these processes should cause a re-evaluation of the comparative costs of handling, treatment, and disposal of agricultural wastes as a solid. Land disposal is another alternative. When agricultural wastes are handled to avoid polluting surface waters, other types of pollution must be avoided. Mere transferral of pollution from one sphere to another will no longer be tolerated. These are among the aspects which this paper deals with. (White-Iowa State)
W71-00935

CATTLE FEEDERS AVOID POLLUTION BY USING WASTES IN IRRIGATION.
Soil Conservation Service, Washington, D.C.

Soil Conservation, Vol 34, No 4, November 1968, p 84-86. 3 fig.

Descriptors: *Farm wastes, *Cattle, *Ponds, *Furrow irrigation, Lagoon, Water pollution, Nebraska, Water Quality Act, Costs, Loess.
Identifiers: *Tractor driven pump, Soil Conservation Service, Feedlots.

Two brothers in Franklin county Nebraska have implemented a system that avoids pollution while fertilizing and irrigating their land. Solid wastes are hauled to the field from their 5 feedlots covering four acres. The rest washes down with every rain and is caught in a farm pond in a natural draw. In the bottom of the pond a lagoon-type pit was dug so there will always be some water available to keep wastes in suspension. From here the suspension is pumped to nearby fields by a tractor driven pump. If it doesn't rain they pump water from their irrigation wall into the pond and out again onto the land. (White-Iowa State)
W71-00939

IRRIGATING WITH ANIMAL WASTE,
Soil Conservation Service, Hermiston, Oreg.
Clarence Underwood.
Soil Conservation, Vol 34, No 4, November 1968, p 81-82. 3 fig.

Descriptors: *Farm wastes, *Hogs, *Irrigation, *Sewage disposal, Effluent, Soil conservation, Odor, Fertilization, Lagoons, Sprinkler irrigation, Nitrogen, Waste dilution, Water pollution.
Identifiers: *Soil Conservation Service, Velocity-controlled water outlets, Holding basin.

Two brothers purchased a civilian housing facility from the Umatilla Army Depot and converted the 57 units to hog production. Wastes from the 22,000 hog per year facility are flushed into a gutter, through a sewer system and into the first of two lagoons. A second holding basin allows additional settlement and dilution of solids. From here it is pumped to irrigate about 500 acres of land. The brothers estimate that their system puts about 5 pounds of nitrogen per acre on a field each time it is irrigated. The crops are fertilized, little odor is noticeable, and no water pollution has been detected. (White-Iowa State)
W71-00941

COST ANALYSIS OF IMPROVED REGULATION OF THE COLUMBIA RIVER TO INCREASE MINIMUM FLOW IN THE HANFORD PLANT VICINITY,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 06A.
W71-00975

NANCE V MERCHANTS' FERTILIZER PHOSPHATE CO (LIABILITY FOR NEGLIGENCE IN POLLUTING A STREAM).
For primary bibliographic entry see Field 06E.
W71-01005

MOODY V BURRELL (REMEDY FOR POLLUTION OF WATER SUPPLY BY DOMESTIC SEWAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01023

DONNELLY BRICK CO V CITY OF NEW BRITAIN (POLLUTION OF RIPARIAN WATERS).
For primary bibliographic entry see Field 06E.
W71-01042

MASONITE CORP V BURNHAM (LIABILITY FOR WATER POLLUTION).
For primary bibliographic entry see Field 06E.
W71-01046

VILLAGE OF WOODBRIDGE V BOGAN (EMINENT DOMAIN AND LIABILITY FOR DAMAGES DUE TO WATER POLLUTION).
For primary bibliographic entry see Field 06E.
W71-01055

EASTON V STATE (AMOUNT OF COMPENSATION FOR TAKING OF LAND AND POLLUTING A STREAM).
For primary bibliographic entry see Field 06E.
W71-01073

SOUTHERN NEW ENGLAND ICE CO V TOWN OF WEST HARTFORD (CITY LIABLE FOR NUISANCE CAUSED BY DUMPING SEWAGE INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01074

OLD DOMINION LAND CO V WARWICK COUNTY (COUNTY HAS LIMITED POWER TO PROHIBIT POLLUTION IN NAVIGABLE RIVER.
For primary bibliographic entry see Field 06E.
W71-01077

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

URBAN WATER POLICIES IN THE DETROIT METROPOLITAN REGION,
Michigan Univ., Ann Arbor. Office of Research Administration.
George M. Walker, Jr., and Norman Wengert.
Available from NTIS as PB-195 313, $3.00 in paper copy, $0.95 in microfiche. Final Report, July 1970. 271 p, 4 map, 8 tab, 1 chart, 166 ref, 10 append. ORA Project 01351. OWRR Project C-1142 (No. 1589).

Descriptors: *Water policy, *Decision-making, Interagency co-operation, Political aspects, Urbanization, City-planning, Municipal water, Administrative decisions, Water districts, Treatment facilities.

Identifiers: *Metropolitan areas, Public policy, Water resource planning, Political equity, Comprehensive planning, Water supply systems.

The report deals with the period after 1959 when the Detroit Water Board took action to become the water supply agency for the entire metropolitan area. The most critical issues of regional water service lie in the area of inter-governmental relations because of the Board's necessity of selling water at wholesale prices to suburban governments. Basic propositions concerning the Detroit situation are: (1) For efficiency in distribution costs and equity for consumers a unified water supply system is best; (2) Physical water supply is not a problem in the Detroit region; (3) Engineering problems of supplying water are minimal because of level terrain; (4) Major problems are political and institutional; (5) Economic problems are not overwhelming; (6) Water policy decisions are dispersed throughout the system; (7) Decisions affecting water policy may be influenced by other problems of dispersed power in the metropolitan area. (Wray-Chicago)
W71-00706

COMPUTERS IN THE RESEARCH AND TEACHING OF HYDROLOGY,
Environmental Dynamics, Inc., Los Angeles, Calif.
Venkateswararao Vemuri.
Progress of Hydrology, Vol 1, p 290-315, July 1969. 26 p, 1 fig, 9 ref.

Descriptors: *Hydrology, *Systems analysis, *Analog computers, *Digital computers, Simulation analysis, Monte Carlo Method.
Identifiers: Hybrid computers, Signal processing, DSCT, CSDT, DSDT.

This paper systematically explored trends of research in simulation and signal processing as they apply to hydrology and how modern computational tools shape the course of events and thinking at educational and research institutes attempting to solve these problems. It was said that hydrology can be divided into two classes: (1) the scientific or technological aspects of the problem and (2) the management or behavioral aspects of the problem. A narrative description of hydrological systems was given. Two distinct formats in problem specification, direct and inverse, were presented in detail. Computational demands in hydrological systems analysis included signal processing problems and simulation problems. The conventional computational tools, which serve the needs of simulation, mentioned were analog computers, digital computers and passive network analogs. The hybrid computer which attempts to take advantage of the attractive features of both analog and digital computers was described. A comparison of the discrete-space and continuous-time (DSCT) technique and the continuous space, discrete-time (CSDT) method as a means of solving a problem numerically was given. A third method of solving was the discrete-space, discrete time (DSDT) method which has been used to identify the transmissibility storage coefficient and boundary of an aquifer. An alternate method mentioned was the Monte Carlo method. (Kriss-Cornell)
W71-00708

STREAMFLOW SYNTHESIS FOR UNGAGED RIVER,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 02E.
W71-00709

FUNCTIONAL EVALUATION OF A WATER RESOURCES SYSTEM,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Tech Paper No 4, The Hydrologic Engineering Center, Corps of Engineers, US Army, Jan 1967. 18 p, 2 fig, 6 tab.

Descriptors: *Computer programs, *Systems analysis, *Hydrologic aspects, *Water resources development, *Reservoir operation, *Simulation analysis, Conservation, Optimization, Costs.
Identifiers: Willamette River Basin, Susquehanna River Basin.

A generalized computer program for evaluating the conservation accomplishments of an extremely complex water resources system developed in the Hydrologic Engineering Center of the Corps of Engineers, US Army was described. The program, 'Reservoir Systems Analysis-Conservation', has been used in preliminary studies to evaluate the functional (hydrologic) accomplishments of large water resource systems in the Susquehanna and Willamette River Basins and of several smaller systems. This elaborate computer program simulated the operation of a water resources system for many conservation functions such as water supply, power generation and low-flood regulation, recognizing the important constraints imposed by flood control requirements. It simulated the operation usually on a month-by-month basis with provision for operation by any regular or irregular intervals. The manner in which the water resources system was described to the computer was illustrated by use of an example for the Willamette River Basin study which considered 27 control points, 13 diversions and 14 reservoirs with 5 power plants. The program was designed for simplicity of use and costs per operation study with a high-speed computer are nominal. (Kriss-Cornell)
W71-00710

METHOD FOR DETERMINATION OF SAFE YIELD AND COMPENSATION WATER FROM STORAGE RESERVOIRS,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 04A.
W71-00711

A HYDROLOGIC WATER RESOURCE SYSTEM MODELING TECHNIQUE,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 04A.
W71-00712

WORTH OF STREAMFLOW DATA FOR PROJECT DESIGN - A PILOT STUDY,
Geological Survey, Sacramento, Calif. Hydrologic Systems Lab.; and Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 04A.
W71-00714

SIMULATION OF DAILY STREAMFLOW,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 02E.
W71-00715

HYDROSTATISTICS - PRINCIPLES OF APPLICATION,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard.
Tech Paper No 15, The Hydrologic Engineering Center, US Army Corps of Engineers, July 1969. 11 p, 41 ref.

Descriptors: *Hydrologic properties, *Statistical methods, *Decision making, *Design criteria, *Probability, Time.
Identifiers: *Hydrostatistics.

The purpose of this paper was to discuss briefly and very generally the nature of hydrologic engineering problems that could be solved through application of statistics and to examine the basic concepts involved in the application of statistics to such problems. The importance of applying statistics to a complete decision process, rather than to an incompletely separable link of that process, was emphasized. Hydro-statistics which have historically been concerned primarily with the determination of the probability or frequency of events and the correlation or interrelation among events, were discussed. It was said that in most cases of hydrologic design, it is traditional to select a design criterion that expresses the adequacy in terms of probability of exceedence. An example of a water supply reservoir that might be designed for a drought that would be exceeded once in 25 years was given. Discussions were based upon the objective of determining expectation over a long period of operation of a specific project design, rather than evaluation of the probability of hydrologic events independent of any design. These included probability of a single event, indirect probability determinations, coincident probability determinations and complex probability problems. Has 41 references. (Kriss-Cornell)
W71-00719

THE MATHEMATICAL SIMULATION OF THE HYDROLOGY OF SMALL WATERSHEDS,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02E.
W71-00720

OPTIMUM GAGING STATION LOCATION,
Geological Survey, Washington, D C.
Nicholas C. Matalas.
Progress of Hydrology, Vol 1, p 473-489, July 1969. 17 p, 6 ref.

Descriptors: *Optimization, *Regression analysis, *Regional analysis, *Flow characteristics, *Gaging stations, Budgeting, Cost.

For an existing network of stations, two approaches were presented for determining an optimal scheme of gaging. Both approaches utilized the correlation between flow sequence to establish a regression relation, whereby, the flow properties of a discontinued station may be inferred from the properties of stations that are not discounted. The first approach sought to identify those stations that were to be discontinued, such that the sum of the variances of the estimates of a flow property at all stations was a minimum subject to a budgetary constraint. Minimizing the sum variances was equivalent to maximizing the total information content. The second approach considered the networks of stations for several regions and sought to identify those stations within the region that may be discontinued, such that the unit cost of information was the same for all regions. This approach was combined with a regional analysis of the information at the stations in an existing network to provide a basis for selecting among many ungaged sites those that are to be gaged. A regression analysis that relates a flow property at each station to a physiograph and metorologic characteristics associated with each station was used. The approaches for both gaged and ungaged sites were illustrated in terms of only one flow property-the mean for a sequence of flow observations. The approaches were quite general and could be applied to many flow properties. (Kriss-Cornell)
W71-00721

MATHEMATICAL METHODOLOGY IN HYDROLOGY,
Arizona Univ., Tucson. Hydrology and Water Resources.
Chester C. Kisiel.
Progress of Hydrology, Vol I, p 362-399, July 1969. 38 p, 3 fig, 1 tab, 71 ref.

Descriptors: *Mathematical modeling, *Hydrology, *Probability, *Systems analysis, *Research and development, *History.
Identifiers: Hydrologic problems.

The purpose of the paper was: (a) to review the current state of the art, both in practice and research, in the use of mathematical methods in hydrology, and (b) to suggest directions for more efficient integration of mathematics into hydrologic education and research. Two dichotomous views in hydrology as contrasted with the philosophy of modern science were identified. The dichotomies were: (a) between the empirical and scientific approaches, and (b) between the deterministic and probabilistic approaches to modeling. In addition, discrete models used in hydrology were contrasted with continuum models. Two types of problems associated with hydrologic systems were described as either direct (forward) or inverse. Direct problems were said to be in the classical tradition and the system was known prior to characterization in terms of a mathematical equation. Classes of inverse problems mentioned include: control, identification, and estimation. Complete summaries of these and other problems were given and included error analysis and problem solving. Current teaching and research in the field of hydrology received comment. Has 71 references. (Kriss-Cornell)
W71-00722

THE ROLE AND DEVELOPMENT OF THE PROGRAMMING LANGUAGE 'HYDRO' IN HYDROLOGY,
Carnegie-Mellon Univ., Pittsburgh, Pa.
George Bugliarello.
Progress of Hydrology, Vol I, p 233-264, July 1969. 32 p, 13 fig, 16 ref.

Descriptors: *Hydrology, *Computer programs, *Programming languages, *History, *Design criteria, *Operations, *Analytical techniques, Water resources development, Engineering.

Summarized were the programming needs in hydrology to which HYDRO, a flexible computer language for water resource engineering, was intended to respond a review of the history, the specifications and design criteria of HYDRO, and a description of the operation of different components of HYDRO systems were presented. The organizations performing broad hydrological work were classified into six categories, according to size of the hydrologic cycle segment with which they are usually most concerned, and also according to their degree of specialization. Three pivotal programming needs in hydrology were considered. The HYDRO system dates back to 1961 and a complete history including design philosophy and specification was given. The five main areas included in the HYDRO library procedures of direct relevance to hydrology, were: frequency analysis, precipitation analysis, hydrograph analysis, open-channel hydraulics, and flood routing. The HYDRO syntax for hydrograph analysis was shown. The writing and operation of HYDRO programs was explained and examples were given. Described were the combination of the features of HYDRO and the universal algebraic computer language ALGOL into a single language HYDRALGOL and other extensions, was said to be an effective tool in the solution of selected problems and in accelerating the training of personnel in the area of hydrologic analyses. (Kriss-Cornell)
W71-00723

MATHEMATICAL MODELING IN HYDROLOGY,
Geological Survey, Menlo Park, Calif.
D. R. Dawdy.
Progress of Hydrology, Vol I, p 346-361, July 1969. 16 p, 91 ref.

Descriptors: *Mathematical models, *Optimization, *Hydrology, *Stochastic processes, *Simulation analysis, *Systems analysis.

This paper described the areas of interest of the working groups under the Committee on Mathematical Models in Hydrology established by the International Association of Scientific Hydrology in October 1967. The three named working groups were: Parametric Hydrology, Stochastic Hydrology and Water Resources Systems and stressed the applications of particular mathematical tools rather than stressing the discipline in which a particular problem occurs. First the purpose of simulation models and types of simulation models were given. Parametric modeling of surface runoff was then shown to be divided into component modeling and integrated system modeling. A section on stochastic modeling gave methods of stochastic simulation and their uses. Mathematical programming, use of stochastic models in systems analysis and other systems analysis techniques were described as part of mathematical modeling of water resources systems based upon the optimization of some goal, subject to constraints imposed upon the system. (Kriss-Cornell)
W71-00724

DETERMINISTIC NONLINEAR HYDROLOGIC MODELS,
Geological Survey, Washington, D.C.
J. Amorocho.
Progress of Hydrology, Vol 1, p 420-472, July 1969. 53 p, 12 fig, 37 ref.

Descriptors: *Hydrology, *Mathematical models, *Optimization, *Water storage, Operations.
Identifiers: *Determinism, *Non-linear models, Functional model, Conceptual model.

The impossibility of formulating any real hydrological situation in strictly deterministic terms because of the problems of time variability, input, output and systems uncertainties, and system representation was discussed. The various types of deterministic models in hydrology were described and examples of their use were given. First, operational representation was described where 'operators' contained in the equations perform mathematical operations on a set of variable to produce a function of these variables. An operational representation of a simple storage system was an example. Functional representation described another way of representing a system. A third major category of deterministic models comprised structures in which a schematization of the hydrologic unit is performed. The name 'conceptual model' was given to this idealized process. The flow diagram of a model which attempted to synthesize the operation of a natural system, termed 'hydrologic systhesis,' was shown. The fact that most methods of the deterministic approach are still in an exploratory stage was summarized. (Kriss-Cornell)
W71-00726

SYSTEMS APPROACHES IN HYDROLOGY AND WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Civil Engineering.
Ven Te Chow.
Progress of Hydrology, Vol I, p 490-509, July 1969. 20 p, 4 fig, 9 ref.

Descriptors: *Hydrology, *Stochastic processes, *Systems analysis, *Water resources development, Mathematical models, Simulation analysis, Economics, Education.

The objective of this paper was to recapitulate current thinking on hydrologic systems, to describe stochastic hydrologic systems, and to discuss hydrologic systems and hydro-economic systems in water resources planning and development. Various parts of the hydrologic system were said to be interception, evaporation, transpiration, infiltration detention, retention, surface runoff, subsurface runoff and groundwater flow, and were considered as hydrologic subsystems. An open-loop system and a closed-loop system were described. Mathematical simulation of natural hydrologic systems achieved by means of either a lumped-system model or a distributed-system model was discussed. Comparisons of non-linear and linear systems, time variant and time-invariant and deterministic and probabilistic were made. Questions posed on the mathematical simulation of the hydrologic system of watersheds at the International Hydrology Symposium in 1967 were restated with some modification. A comparison of the conventional approach and the stochastic approach in hydrologic systems analysis was illustrated. A view of the system approach as part of the hydroeconomic system for water resources planning and development was shown through an outline of the educational programs in water resources engineering followed by many universities. (Kriss-Cornell)
W71-00727

DETERMINISTIC LINEAR HYDROLOGIC SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Peter S. Eagleson.
Progress of Hydrology, Vol I, p 400-419, July 1969. 20 p, 38 ref.

Descriptors: *Linear programming, *Mathematical models, *Optimization, *Groundwater movement, Surface runoff, Reservoirs, Hydraulic systems.
Identifiers: Determinism, Identification problems.

This paper attempted to answer the question of why hydrologists devote so much time to linear deterministic methods in a non-linear stochastic real world. A reply was given with respect to determinism and with respect to linearity. Mathematical representation of linear systems was described using differential equations and integral equations. The approach to finding the kernel of a linear hydrologic system through the solution to the linearized differential equation which best represents the phenomenon of interest was proposed. Surface runoff, infiltration and capillory use, and groundwater motions were considered. A second approach to finding the kernel of a linear hydrologic system was through a synthesis of system behavior in terms of one or more lumped elements which reproduce, in linear form, the primary hydraulic operations such as storage and translation of concern to the phenomenon being modelled. Linear reservoirs, linear channels, combined linear elements and conceptual linearization were considered. The problem of determining the system kernel, or 'the identification problem,' was discussed. Identification of either truly linear or optimally linear systems was distinguished. 'Black box' methods or 'parametric' methods were regarded as further subdivisions of the identification problem. A review of techniques for finding linear kernels given observations of system input and output was given. (Kriss-Cornell)
W71-00728

THE COMPUTER AND HYDROLOGY,
California Univ., Riverside. Dry-Lands Research Inst.
Warren A. Hall.
Progress of Hydrology, Vol I, p 226-232, July 1969. 7 p.

Descriptors: *Computers, *Hydrology, *Parametric hydrology, *Stochastic processes, Statistical methods, Mathematical models.

A brief review of the trends toward mathematical sophistication in hydrology was presented in order to put in proper perspective some ideas of the role of computers in the future of hydrology. Included were: the parametric approach, i.e., the identification of a set of parameters which described the 'state' of the watershed and the functions by which state determines the response to the input precipitation function; and the stochastic approach which used direct statistical analysis to estimate the average return period between floods at any given magnitude. Both of these procedures have received a major impetus with the advent of the computer. Some of the shortcomings of the present computer based developments in hydrology were discussed. It was felt that the most urgent concern was for the application of systems identification and similar analytical techniques to develop physically based

d physically describable models of the principal teractive hydrological processes. (Kriss-Cornell)
71-00729

MODEL OF OPTIMUM WATER ALLOCA-ON UNDER IOWA'S PERMIT SYSTEM,
wa State Univ., Ames.
A. Baldwin.
esis, Master of Science, Iowa State, 1970. 147 p, fig, 27 tab, 2 append, 107 ref. OWRR Research eport No. B-009-1A (1).

escriptors: *Optimization, *Linear programming, Water allocation (Policy), *Model studies, ystems analysis, Hydrologic aspects, Economics.
entifiers: Iowa's water permit system.

e three objectives of this study were: (1) to alyze Iowa's water permit system, constructing estimate of the system's allocation in times of ter scarcity; (2) to construct a model which will eld in specific situations both an optimum water e pattern and values for water in its various uses;) to apply the model developed in objective two d the estimate constructed in objective one to a ecific situation. Three procedure phases were scribed. The first phase was examined as a physi- l and as a economic entity and then the necessary d sufficient conditions for optimum resource al- cation were derived. The second analytical phase amined origins and general characteristics of al- cative mechanisms currently in use in the United ates. A specific hypothesis based on Iowa's per- t system was developed and a general model hich utilized linear programming to describe the teraction between hydrologic and economic stems, generating approximate values for water timally allocated among various uses, was veloped. The third phase of the study was empiri- l and consisted of application of the linear pro- amming model to two water use situations, one al, the other hypothetical. A description of the sults of the applications was given. Recommen- tions for further research were suggested. (Kriss- rnell)
71-00730

SE OF ANALOG COMPUTER IN GROUND-ATER HYDROLOGY,
innesota Univ., Minneapolis. Water Resources esearch Center.
r primary bibliographic entry see Field 04B.
71-00732

HE PROGRESS OF HYDROLOGY.

ew Developments in Hydrology, IHD and NESCO, Vol I, 1969. Proceedings First Interna- nal Seminar for Hydrology Professors, July 13- , 1969, Univ. of Illinois, Urbana, 509 p, nu- erous fig, tab, append. NSF Advanced Science eminar.

escriptors: *Hydrology, *Hydrologic education.

s a first step to meet the need for a more progres- ve hydrologic education in government as well as scientific committees, an International Seminar r Hydrology Professors was held from July 13 to , 1969, in Urbana, Illinois on the Urbana-Cham- aign Campus of the University of Illinois. The minar was aimed at an advanced level of discus- on and exploration in hydrologic education. A tal of 62 papers were presented and preprinted r distribution at the seminar. Of these papers, 20 ere on new developments in hydrology, 19 on ecialized subjects in hydrology, 10 on hydrologic ducation and 13 on various country reports. All bmitted papers and discussions were included in e Proceedings under four main headings: new evelopments in hydrology, specialized subjects in ydrology, hydrologic education, and discussions. pecific objectives of the seminar included discus- ons on new developments in stochastic analysis, nd systems simulation and model formulation and provide discussion of teaching and research methods, techniques, and instrumentation including facilities for hydrologic laboratories and teaching aides. (Kriss-Cornell)
W71-00733

INVESTMENT ANALYSIS UNDER UNCERTAINTY
Stanford Univ., Calif. Graduate School of Business.
Robert Wilson.
Management Science: Application, Vol 15, No 12, Aug 1969, pp B650-664. 15 p, 2 fig, 11 ref, 1 append.

Descriptors: Investment, Analysis, Interest, Mathematical models, Time, Project planning, Diversification, Risks, Optimization, Design.
Identifiers: Event tree, Smoothing effect.

Investment projects were described as a pattern of uncertain cash flows over time; i.e., as a cash flow pattern over an event tree. Sufficient conditions for accepting and rejecting individual projects were formulated as mathematical programming problems which were amendable to routine application at subordinate levels of an organization. The time dimension of a state description was made explicit by constructing the 'event tree' specifying the sequence of states that it can obtain. An example of the event tree over four time periods was given where the number of possible states was finite, each state had only one successor node, and each node had only one predecessor arc. An abbreviated project description was used for the purpose of analysis of the state-relevant description of investment projects. The methodology of investment analysis under uncertainty was described where two characteristic rationale were used: 'smoothing' effect and 'diversification' effect. Examples were given. The sufficient conditions for inclusion of projects and exclusion of projects and the systematic analysis of these solutions were investigated. Finally, a mathematical programming formulation was developed which embodied measures of risk aversion and intertemporal income preferences. The optimal design of a complementary financing program for a project yielded inclusion criteria for its acceptance, and analysis of the borderline case between risk aversion and risk preference yielded an exclusion criterion. This paper has relevance to water resources investments having uncertain future returns. (Kriss-Cornell)
W71-00734

SOME ASPECTS OF EDUCATION AND RESEARCH IN STOCHASTIC HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Vujica Yevjevich.
The Progress of Hydrology, Vol I, pp 316-333, July 1969. 24p.

Descriptors: *Stochastic processes, *Hydrology, Mathematical modes, *Statistical methods, *Digital computers, *Hydrologic data, Engineering, Data collection.
Identifiers: Time-space trade.

Some crucial subjects considered as being significant for education, researchand practical developments in hydrology for the next decade were presented. First three types of hydrologic processes: deterministic, stochastic and combined deterministic-stochastic were described. The roles of probability theory, mathematical statistics and stochastic processes in hydrology and water resources were catagorized into three types and can be applied in advancement in research and education. Discussed was the use of computers in hydrology especially the digital computer which has made many hydrologic equations, methods and procedures of pre-computer age absolete. The problem of hydrologic data scarcity and the application of statistics was also discussed. Two basic and opposite approaches used in design of a hydrologic observation system mentioned: were a) hydrologic approach, which includes climatologic, hydrogeologic, general geophysical and similar points of view; and b) engineering approach, which is dominated by civil, hydraulic or sanitary engineering points of view. Other topics included were: transfer of hydrologic information from point to point, transfer of information from one hydrologic variable to another, risk and uncertainty in hydrologic information, procedures for extracting the most information from a given hydrologic amount of data and effect of additional short-term observations on total information. A time-space trade concept was explained which is a promising approach for regions with crucial scarcity of data. (Kriss-Cornell)
W71-00735

PRODUCTION AND INVESTMENT IN NATURAL RESOURCE INDUSTRIES,
Montana State Univ., Bozeman; and Resources for the Future, Inc., Washington, D.C.
Oscar R. Burt, and Ronald G. Cummings.
American Economic Review Vol LX, No 4, p 576-590, September 1970.

Descriptors: *Optimization, Depreciation, Discount rate.
Identifiers: *Social benefit function, User-cost, Lagrangian expression, Opportunity cost.

The authors develop a general model for social production and investment in natural resource industries which can be adapted to any specific resource. The social benefit function is formulated subject to constraints and the Lagrange method used for a solution. The optimum time paths for production and investment are generated by the model while assuming society's planning horizon is finite. The decision rule for the optimum time path of resource use is to increase production until net marginal social benefits equal user costs (as defined in the model). The optimum time path for social investment occurs when the marginal social cost of investment in the current period is equal to the discounted value of the increment to all future capital stocks associated with an increment to current investment. The model is generalized to include multiple interrelated resources and capital stocks and infinite planning horizon. This model is of interest to water studies concerned with planning the development of water resource sites. (Siegenthaler-Rutgers)
W71-00751

COMMENTS ON TIME-CAPACITY EXPANSION OF URBAN WATER SYSTEMS,
Cornell Univ., Ithaca, N.Y.
Marshall Gysi.
Water Resources Research Vol 6, No 3, p 993-995, June 1970.

Descriptors: *Water supply, *Mathematical models, *Demand, *Forecasting, Economic evaluation, Prices, Cost minimization, Maximization, Optimization, Economies of scale, Water shortage, Dynamic programming, Benefits.
Identifiers: *Community surplus, *Over-demand, Derived demand.

The author elaborates on a method previously developed by Russell Scarto for estimating a more economically efficient capacity expansion schedule for a municipal water supply utility. He points out that recent studies on consumer demand relationships for water provide information that should be included in mathematical models which have as their object the maximization of the net present value of future community economic surpluses. In planning for system capacity a less than infinite penalty cost should be included for optimum welfare. The author outlines how losses due to overdemand can be estimated from the consumer's demand function. He presents a dynamic programming approach for the estimation of the expansion path of the water supply facilities which maximizes the present value of future marginal net benefits to the community. The article concludes with a statement of the importance of further research in the area of water pricing and consumer demand. (Murphy-Rutgers)

W71-00757

PRICE DISTORTION AND ECONOMIC WELFARE,
Minnesota Univ., Minneapolis; and Pennsylvania State Univ., University Park.
Edward Foster, and Hugo Sonnenschein.
Econometrica, Vol 38, No 2, p 281-297, March 1970.

Descriptors: *Welfare economics, *Model studies, *Economic evaluation, *Mathematical studies, *Taxes, Prices, Optimization, Social aspects, Government, Government supports, Budgets, Equilibrium, Costs.
Identifiers: *Subsidies, *Marginal rate of transformation, *Marginal rate of substitution, Utility, Economic distortion.

This paper presents an economic model in which equilibrium positions are characterized by specified inequalities between society's marginal rates of transformation in production and consumers' marginal rates of substitution in consumption. This condition is often present in water resource development projects due to the presence of externalities in both the consumption and production of a water supply system. The authors use the device of certain mapping defined on the set of efficient production in order to investigate the effect on welfare from changes in the inequalitites. The paper proceeds to derive the mathematical restrictions which these mappings must satisfy in order to yield positive results and to specify what conditions are necessary for these restrictions to hold. The analysis leads to the conclusion that a radical decrease in a specific economic distortion will improve welfare. (Murphy-Rutgers)
W71-00766

OPTIMALITY, 'PUBLIC' GOODS, AND LOCAL GOVERNMENTS: A GENERAL THEORETICAL ANALYSIS,
Northwestern Univ., Evanston, Ill.
Mark V. Pauly.
Journal of Political Economy, Vol 78, No 3, p 572-585, May/June 1970.

Descriptors: *Optimization, Marginal utility, Marginal costs, Migration.
Identifiers: *Public goods, Net benefits, Pareto optimal, Edgeworth box, Neighborhood effects.

This paper attempts to reconcile divergent analyses with respect ot the Pareto optimality conditions in the provision of a public good by politically separate local governments. The confusion has occurred because of the failure of researchers to specify in what way the local public good being considered has elements of publicness. To clarify matters, four cases of goods within and between communities are considered: (1) purely private, (2) purely public, (3) purely public good within but private between, (4) impurely public within but private between communities. In each case, the pure public good in the Samuelson sense is identified and equilibrium and optimality conditions for that good are specified. The actual element of publicness for each case is analyzed and the deviation from the optimum is shown for local government actions. Special attention in case four is given to the problem of education and migration, and the author shows some departures from the optimum. This analysis is of relevance to water managers concerned with the welfare implications of water resource development. (Siegenthaler-Rutgers)
W71-00770

A NOTE ON ENGINEERING EMPIRICISM AND ECONOMIC THEORY,
Oak Ridge National Lab., Tenn.
Duane Chapman.
Engineering Economist Vol 15, No 4, p 243-248, Summer 1970.

Descriptors: *Cost minimization, *Mathematical studies, *Optimization, *Economic evaluation, Prices, Engineering, Estimated costs, Cost analysis.
Identifiers: *Homogeneous production function, Lagrangian optimization, *Scale factor.

The author explores the linkage between the economic concepts of the homogeneous production function and Lagrangian optimization and the use, in engineering cost estimates, of a scale factor in cost extrapolation. A common example of a scale-factor equation in engineering design is given. This equation can be derived by minimizing the cost of production for any fixed output point for a homogeneous production function. The author concludes from this analysis that the homogeneous production function and the scale-factor cost equation may be representations of some underlying physical reality. Since engineering and economic concepts are both used in water resource cost analysis this article explains the relationships between these familiar techniques and concepts. (Murphy-Rutgers)
W71-00771

OPTIMAL DEPARTURES FROM MARGINAL COST PRICING,
Princeton Univ., N.J.
William S. Baumol, and David F. Bradford.
American Economic Review Vol LX, 1103, p 265-283, June 1970.

Descriptors: *Welfare economics, *Prices, *Marginal cost, *Taxes, *Optimization, Resource allocation, Mathematical study, Government, Demand, Equilibrium, Social aspects, Elasticity of demand, Profits, Costs.
Identifiers: *General equilibrium, *Second-best, Price elasticity, Excise tax, Income tax, Pareto optimality.

The authors are concerned with those situations where deviations from marginal cost pricing are necessary for optimal resource allocation. This condition has particular relevance for utility pricing and should make the article of interest to pricing policy studies in water utilities. Due to the effects of taxes, the problem is in the area of second best and the solution arises from the theory of taxation and the analysis of public utility regulation. The paper describes the rules indicating whether a particular price-output combination which satisfies the profit constraint is socially optimal. The authors discuss four variants of the usual welfare optimization theorem, each of which gives a set of necessary conditions for quasi-optimal pricing. A simple general equilibrium model is then presented and the effect of taxes on different sectors of the economy explained. The authors conclude their analysis with an outline of the past literature of this problem. (Murphy-Rutgers)
W71-00773

TWO METHODS OF COMPUTING FULL-INFORMATION MAXIMUM LIKELIHOOD ESTIMATES IN SIMULTANEOUS STOCHASTIC EQUATIONS,
IBM Watson Research Center, Yorktown Heights, N.Y.
Gregory C. Chow.
International Economic Review Vol 9, No 1, p 100-112, February 1968.

Descriptors: *Mathematical studies, *Statistics, *Economic evaluation, *Maximization, Least-squares method, Regression analysis, Probability.
Identifiers: *FIML, *Iterative method, Nornal equations, Limited information, Convergence.

This paper attempts to derive an explicit set of equations for full-information maximum likelihood estimates of parameters in a system of simultaneous linear stochastic equations. It also presents two iterative methods of solving these equations. Assuming, all structural equations to be stochastic, a set of normal equations is derived. The author discusses the treatment of identities and linear restrictions on coefficients and gives a numerical example. This article is relevant to the water researcher interested in the use of simultaneous equation systems for estimating water models. (Murphy-Rutgers)
W71-00774

SOME EFFECTS OF INCORRECT SPECIFICATION ON THE SMALL-SAMPLE PROPERTIES OF SEVERAL SIMULTANEOUS-EQUATION ESTIMATORS,
British Columbia Univ., Vancouver.
John C. Cragg.
International Economic Review Vol 9, No 1, p 63-86, February 1968.

Descriptors: *Mathematical studies, *Economic evaluation, *Model studies, *Statistics, Sampling, Least squares method, Regression analysis, Probability.
Identifiers: *Misspecification, Ordinary least squares, Two-stage least squares, Estimators.

This paper provides some sampling experiment results exploring the effects of certain misspecifications on several simultaneous equation estimators. The main type of misspecification investigated is the incorrect exclusion of variables from certain equations or the model itself. Experiments are reported where important non-zero coefficients were specified to zero in the structure estimated and there is a discussion of the effects of the specification of small coefficients to be zero in order to obtain identification. The omission of an exogenous variable from the estimated structure is considered along with the related aspect of omitting an equation. The last problem discussed is that of the effects of failing to specify as zero all the structural coefficients for which such a specification would be valid. The general conclusion of the author, is that the different failures of specification investigated may have serious effects and he suggests a difficult task, in econometric model-building, of steering between misspecification and underspecification. This paper is relevant for the choice of variables in econometric studies of water resources. (Murphy-Rutgers)
W71-00775

NONLINEAR SIMULTANEOUS EQUATIONS: ESTIMATION AND PREDICTION,
Princeton Univ., N.J.
Stephen M. Goldfeld, and Richard E. Quandt.
International Economic Review Vol 9, No 1, p 113-136, February 1968.

Descriptors: *Mathematical studies, *Statistics, *Forecasting, *Regression analysis, Sampling, Model studies, Computers, Maximization.
Identifiers: *Two stage least squares, *Direct least squares, *FIML, *Nonlinearities.

This paper analyzes the small-sample properties of the parameter estimates of two specific nonlinear systems. The authors present two models on which they conducted experiments consisting of generating normally distributed error terms, solving the structural equations for the values of the endogenous variables and using the resulting data series to estimate the coefficients of the equations with several techniques. The estimating methods used were; direct least squares, (DLS), full-information maximum likelihood (FIML) and two-stage least squares. The evidence gathered by the authors favor FIML over the two-stage procedures and both over DLS for structural estimation as well as prediction. The potential use of nonlinear equations in econometric water resource studies makes this paper of interest to the water researcher. (Murphy-Rutgers)
W71-00776

COST ANALYSIS OF IMPROVED REGULATION OF THE COLUMBIA RIVER TO I

CREASE MINIMUM FLOW IN THE HANFORD PLANT VICINITY,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
R. W. Legan, and R. T. Jaske.
AEC Research and Development Report, BNWL-1343, UC-70, June, 1970, p 69. 25 fig, 2 tab, 3 ref. US AEC Contract AT (45-1)-1830.

Descriptors: Temperature, Regulation, Economics, Flow, Hydrographs, Transmission (Electrical), Annual costs, Electric power, Washington.
Identifiers: Hanford plant, Thermal discharge, Penalities, Flow management.

This report reviews the operational history of the week of October 24-31, 1967 with respect to the actual operations of the Priest Rapids Project and the resulting effects on the flow of the Columbia River. These effects are compared with the degree of management also exerted at the McNary project during the time period. The adverse effects of the uncoordinated regulation of the Columbia River are summarized with respect to Washington State temperature standards. The linear program code UMPIRE was used to model the actual conditions and, by superposition, minimum flow constraints ranging upwards from 36,000 cu ft /sec by 10,000 cu ft /sec increments were imposed on the Hanford reach. All scheduled power and energy demands of the Priest Rapids project and the McNary project that existed on that week were met. The economics suggest that large reductions in the cost of proposed navigation channel facilities can be made by basing the channel design on 66,000 cu ft/sec or higher minimum flows in the Hanford reach. The extra cost for energy losses and management represent a small fraction of the construction cost reduction when capitalized. The study shows the great benefits to multipurpose river use from system coordination on a regional rather than a separate private-federal basis as exists currently. (Upadhyaya-Vanderbilt)
W71-00975

DETERMINISTIC NONLINEAR HYDROLOGIC MODELS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-01081

MULTIVARIATE ANALYSIS IN GROUNDWATER HYDROLOGY -- THEORY,
California State Coll., Long Beach. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-01098

6B. Evaluation Process

COMPARATIVE COST EVALUATION OF DESALTED WATER SUPPLY VERSUS ALTERNATIVE FRESHWATER SUPPLY FROM A CONVENTIONAL SOURCE,
Southwest Research Inst., Houston, Tex.
For primary bibliographic entry see Field 03A.
W71-00569

REORIENTATION OF OUR SALINE WATER RESOURCES THINKING,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 03A.
W71-00576

SYSTEMS APPROACH TO THE EVALUATION OF BENEFITS FROM IMPROVED GREAT LAKES WATER QUALITY,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-00707

FUNCTIONAL EVALUATION OF A WATER RESOURCES SYSTEM,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 06A.
W71-00710

SYSTEMS APPROACHES IN HYDROLOGY AND WATER RESOURCES,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-00727

SOME NEW VIEWS ON THE PAYBACK PERIOD AND CAPITAL BUDGETING DECISIONS
Rochester Univ., N.Y. Coll. of Business Administration.
H. Martin Weingartner.
Management Science: Application, Vol 15, No 12, Aug 1969, p B594-B607. 14 p, 1 fig, 1 tab, 25 ref.

Descriptors: Analysis, Constraints, Budgeting, Capital, Decision making Optimization, Investment, Cost, Time.
Identifiers: *Payback period, Quantitative concepts.

Water resources and other capital budgeting problems are often solved by use of the payback period, when present value or internal rate of return criteria are inadequate. The Payback Period is the time expected for an investment project to recoup its initial cost. In a discussion of this approach the payback concept was considered in its role as a criterion versus a payback constraint, as a break-even concept, and as a crude measure of the rate of resolution of uncertainty. It was shown that the payback reciprocal as a measure of the rate of return of a project had significance in the context of certainty. It was more appropriate to regard payback as a constraint which a project must satisfy than as a criterion which was to be optimized. The inherent differences between financial investments and investments in capital projects by firms were also discussed. (Kriss-Cornell)
W71-00731

INVESTMENT ANALYSIS UNDER UNCERTAINTY
Stanford Univ., Calif. Graduate School of Business.
For primary bibliographic entry see Field 06A.
W71-00734

COMMUNITY GOALS-MANAGEMENT OPPORTUNITIES: AN APPROACH TO FLOOD PLAIN MANAGEMENT
Chicago Univ., Ill. Center for Urban Studies.
John R. Sheaffer, George W. Davis, and Alan P. Richmond.
Community Goals-Management Opportunities: An approach to Flood Plain Development. Washington, D.C.: Center for Economic Studies, U. S. Army Engineer Institute for Water Resources, IWR Report No 70-2, May 1970. 209 p, 15 fig, 3 map.

Descriptors: *Flood Plains, *Methodology, *Planning, *Management, Decision-making, Urbanization, Social aspects, City planning, Cities, Community development.
Identifiers: *Flood plain management, *Comprehensive planning, *Urban development/redevelopment, *U. S. Army Corps of Engineers, Water resource management.

This report focuses on the relationships between flood plain management, comprehensive planning, water resource management and urban development/redevelopment. Its primary purpose is to assist the Corps of Engineers in becoming an active participant in urban development/redevelopment where flood plain management is involved. A four-step decision-making model for analysing flood plain management alternatives is outlined. The normative model is applied to the demands of four case studies. Results point up the benefits which could be realized if flood plain management and urban development/redevelopment were related. Operational and programmatic implications are identified and discussed. (Wexman-Chicago)
W71-00736

THE ECONOMICS OF CLEAN WATER, SUMMARY.
Federal Water Pollution Central Administration, Washington, D.C.

I67.1/2:970 Summary For sale by the Superintendent of Documents, U. S. Government Print Office, Washington, D.C. 20402 Price $0.50 per copy. Report, March 1970. 41 p, 2 fig, 16 tab.

Descriptors: *Economics, *Waste water treatment, *Investment, Decision-making, Political aspects, Social values, Legislation, Evaluation, Chemical wastes.
Identifiers: *Policy decisions, Municipal grant legislation, Economic analysis, Animal wastes.

The basic product of this study is the definition of a rate of investment that will close the gap for municipal and industrial waste treatment within a five year period, given the continued pertinence of today's regulatory and technological conditions. Detailed studies of the pollutional impact of the inorganic chemicals industry and of concentrated animal populations are submitted as separate subreports. Several issues germane to the policy decisions required with expiration of current municipal grants legislation are discussed. Economic analysis can provide insights into the consequences of alternative actions, but the political process must in the final analysis mold the necessary decisions within the context of total national interests and values. (Davis-Chicago)
W71-00737

THE ECONOMICS OF CLEAN WATER, VOLUME ONE.
Federal Water Pollution Control Administration, Washington, D.C.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $1.50 per copy. I67.112:970 Vol 1. Report March 1970. 168 p, 9 fig, 53 tab, 1 append.

Descriptors: *Economics, *Waste water treatment, *Investment, Costs, Industrial wastes.
Identifiers: Federal assistance programs, Public investment, Regional waste water treatment systems.

This volume addresses itself to the basic question of defining a rate interest that will close the gap for municipal and industrial waste treatment, within a five year period. A number of subsidiary issues are also considered, including the influence of industrial waste discharges on public investment outlays, the influence of location on unit investment, the status of broadly integrated regional waste handling systems, the incidence of recapitalization, the influence of price levels on investment, and patterns of change in the real cost of waste treatment facilities. Consideration of these questions was consistently pointed to their relationship to the problem of deriving a normative annual level of investment, one appropriate to five year attainment of an investment equilibrium in the public waste treatment section; and the force of Federal assistance programs on investments is a minor theme that pervades the report. (Davis-Chicago)
W71-00738

WATER-RELATED FACILITIES STUDY FOR THE COMPREHENSIVE REGIONAL PLAN.
Franklin County Ohio Regional Planning Commission, Columbus, Ohio.

Available from NTIS as PB 189 007, $3 in paper copy, $0.95 in microfiche. Franklin County Regional Planning Commission, Columbus, Ohio, Dec

1969. 137 p, 18 tab, 23 plate, 9 fig. HUD Project Ohio Pa46G X-1105-2.

Descriptors: *Planning, *Water resources, *Water management (Applied), *Water policy, Water supply, Water quality, Sewerage, Drainage, Flood control, Aesthetics, Recreation, Financing.
Identifiers: *Comprehensive planning, *Water resources planning, Implementation, Sewage systems, Regional water authority, Franklin County, Ohio.

This report provides a plan for the development and distribution of water supplies, and for flood control, sewerage and drainage, all on a regional scale. The need for both water supply and flood control is emphasized. Water supplies are to be developed from streams with upground storage reserviors, and from wells. On-stream reservoir sites are proposed as flood control projects. Aesthetic and recreational potentials of such a development are pointed out. Sources of funding are listed and implementation through a regional water authority recommended. (Wexman-Chicago)
W71-00739

THE NORTHEAST OHIO WATER DEVELOPMENT PLAN PROGRAM FOR ACTION,
Ohio Dept. of Natural Resources, Columbus; and Stanley Consultant, Cleveland, Ohio.
S. L. Frost, and Robert H. Anderson.
Water Resources Bulletin, Vol 6, No 4, p 550-555, July-August 1970.

Descriptors: *Water Resources Development, *Water management (applied), Watershed management, Water pollution control, Water supply, Coordination, Social aspects, Economics, Environment.
Identifiers: *Northeast Ohio.

The Northeast region is one of five major water planning management regions in Ohio. Environmental problems associated with the growth of the Northeast Ohio metropolitan region are a serious threat to this heavily populated area. If Northeast Ohio is to continue to grow and be an acceptable and desirable place to live, total systems management of water resources and waste product disposal is a must. The Northeast Ohio Water Development Plan will include water management programs for the next several decades. Guidelines for growth and specific project recommendations will be developed, but with realization that the plan must be flexible and sensitive to changing sociological, economic and environmental conditions. The initial volumes of this report have already been published. It was recommended that the comprehensive plan involve consideration of eight major categories: regional growth, water supply, water quality and pollution control, water reclamation and reuse, recreation, solid wastes, erosion and flood control, and institutions (governmental and financial). The program is designed to take advantage of Federal grants for studies and plan formulation. Separate studies should be undertaken under each of the programs. The Northeast Ohio Water Development Plan would then emerge as a series of reports coordinated and drawn together by a project management team under the guidance of the Dept. of Natural Resources. (Marriott-Chicago)
W71-00740

EVALUATING SUBJECTIVE RESPONSE TO THE RECREATION ENVIRONMENT: A QUANTITATIVE ANALYSIS OF DISSIMILAR PREFERENCES FOR THE VISUAL CHARACTERISTICS OF BEACHES,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
Edward S. Neumann, and George L. Peterson.
Outdoor Recreation Opportunity Needs and Desires, Technical Report no. 1, Evanston, Illinois, February 1970. 176 p, 18 fig, 14 photo, 25 tab, 62 ref. U. S. Public Health Service Grant No 5 R01 EC 00301.

Descriptors: *Mathematical models, *Methodology, *Recreation facilities, *Planning, *Recreation demand, *Beaches, Swimming, Aesthetics, Social aspects.
Identifiers: *Visual characteristics, *Subjective responses.

In order to design an urban environment which will provide maximum benefits at a minimal cost, the planner must develop ways to analyze its effectiveness in meeting a broad range of human needs. Outlined here is a general conceptual and analytical approach to evaluate human response to the visual aspects of the recreation environment. A man-environment interaction is expressed mathematically as R-f (x), i.e., response is a function of environmental characteristics. An outline is made of methodological techniques with three structures indicated: response is quantitatively modeled in a manner which permits analysis of differences among individuals; environmental characteristics are modeled in a manner which permits analysis of the differences which may exist among different types of environments; mathematical transformations are used to specify the relationships between response, environmental characteristics, and other attributes of the individual. In the first chapter a man-environment response relationship is hypothesized with a series of simulated beach environments and a sample of beach users utilized to test and verify the model. Next, relationships between user response and other user attributes are examined to determine whether subjective preference is also related to other variables relevent for evaluating environmental effectiveness. Finally, the hypothesized mathematical preference model is examined to determine its strong and weak points. (Preckwinkle-Chicago)
W71-00742

REVIEW AND INTERPRETATION OF EXPERIENCES IN WATER RESOURCES PLANNING,
Resources for the Future, Inc., Washington, D.C.
Irving K. Fox.
In: Organization and Methodology For River Basin Planning, Atlanta, Georgia Institute of Technology, 1964, p 61-88.

Descriptors: *Planning, *Water resource development, *River basins, Canals, Government, Rivers, Water law, Federal jurisdiction, Tennessee Valley Authority, Costs, Economic evaluation, Optimization, Economic efficiency, Benefit cost analysis.
Identifiers: *Planning history, *Pre-World War II planning, *Post World War II planning, *Value optimization, *Administrative efficiency.

In this paper the author presents his interpretation of the significance of recent studies and experience for water resources planning in this country. The first part of the paper presents a broad overview of the main features of past water resources planning up to World War II. The second part is concerned with water resources planning since that time and seeks to examine the alternative approaches which have been used in recent years. The author distinguishes the six approaches which have been attempted and evaluates them on the basis of their administrative efficiency as well as their economic efficiency. (Murphy-Rutgers)
W71-00743

ORGANIZATION AND METHODOLOGY FOR RIVER BASIN PLANNING.

Atlanta, Georgia, Water Resources Center, Georgia Institute of Technology, 1964, 561 p.

Descriptors: *Planning, *River basin development, *Management, *Government, Economic evaluation, Hydrology, Rivers, Flood control, Recreation, Cost, Water supply, Water pollution, Navigation, Hydro-power, Irrigation, Conservation, Engineering, Financing, Optimization, Social aspects.
Identifiers: *U. S. Study Commission, *Southeast River Basins.

This book is based on the results of a seminar and represents a number of opinions regarding the state of the art of comprehensive river basin planning. Specific attention is given to the completed work of the U. S. Study Commission (USSC) for the Southeast River Basins (SERB). The history of the USSC-SERB is presented and a summary description of its report is provided in the introduction. The book is organized in the same manner as the seminar and consists of papers presented on the USSC-SERB experience as well as on the general nature of river basin planning. These are followed by several discussants presenting critical evaluations of the main paper. The background and perspective in Federal river basin planning is discussed followed by papers on the organization and procedures of the USSC. The basic studies concerned with the economic, hydrologic, climatic, engineering, geology and cost aspects are explained and criticized. Functional studies dealing with the specific aims and objectives of river basin planning are also given. The different aspects of plan preparation are then discussed and in the final section, there is an evaluation of USSC-SERB program. (Murphy-Rutgers)
W71-00744

WATER SUPPLY, ECONOMICS, TECHNOLOGY AND POLICY,
California Univ., Los Angeles; Rand Corp., Santa Monica, Calif.; and Indiana Univ., Bloomington.
Jack Hirshleifer, James C. DeHaven, and Jerome W. Milliman.
Chicago, University of Chicago Press, 1969, 386 p.

Descriptors: *Water supply, *Economic evaluation, *Technology, Prices, Water quality, Hydrology, Water distribution, Natural resource allocation, Economic justification, Costs, Marginal costs, Average costs, Time, Risks, Taxes, Government, Capital costs, Desalination, Irrigation, Flooding, Water law, Decision making, Economic efficiency, Economic welfare.
Identifiers: *New York, *California, Feather River, Hudson River.

This book provides an introduction to the application of economic and technological knowledge to the solution of practical problems in the area of water supply. The water problem as it pertains to the future availability, price, and quality of water is discussed followed by an explanation of the present state of water resources development. The authors apply economic analysis to the problem of utilizing existing water supply and explain and criticize the usual allocation process. Theoretical principles of correct pricing are applied in the practical context of municipal water utilities and present industry pricing practices are criticized. The authors investigate the theoretical criteria for determining when expansions of water supplies should take place and which of the many technologically possible projects should be adopted. The portions of the hydrologic cycle from which supplies of water may be obtained are discussed as well as the technological propspects and the costs of procuring, treating and distributing water in a variety of ways. Following an explanation of the relevant water law, there are two case studies of areas which experiences a water shortage. (Murphy-Rutgers)
W71-00745

VALUES AND CONCEPTS IN CONSERVATION,
Oregon Univ., Eugene.
Edward T. Price.
In: Readings in Resource Management and Conservation, edited by Burton, Ian and Kates, Robert W., Chicago, University of Chicago Press, 1965, pp 237-254.

Descriptors: *Natural resource development, *Conservation, Resource allocation, Government, Population, Water power, Air pollution, Land, Technology, Economic evaluation, Waste, Risk, Taxes, Social aspects.
Identifiers: *Laissez-faire, Time preference, Socialization.

This article considers the ideological foundations of natural resource conservation as a means to future material welfare. The author considers certain basic values and ideas, such as limitations on the future of primitive man, the expanding future of industrial man, self-identification with the people of the future, and the population of the future. The conventional concepts of resources and the limits of natural resources are surveyed. Based on these results, objectives of conservation policy are suggested. Some of these include: even utilization over all time, preference for the present, prevention of waste, protection of potential resources, and group effect on resources. Conservation techniques in both capitalistic and communistic economies are compared and used to show the need for government intervention in conservation problems. This need arises from the failure of laissez-faire in the area of resource use by the individual who closes pragmatism over conservation. This article has general relevance to water resources by providing background thoughts on the conservation theme. (Murphy-Rutgers)
W71-00746

THE CONTRIBUTION OF PAST METHODS TO PRESENT DAY PLANNING,
Victoria Univ. (British Columbia).
W. R. Derrick Sewell.
In: Regional Planning-Challenge and Prospects, ed. by Hufschmidt, M. M. New York, Frederick A. Praeger, 1969, p 92-97.

Descriptors: *Planning, *Environmental effects, *Water quality control, Recreation, Water pollution, Air pollution, Technology, Floods, River basins, Investments.
Identifiers: *Flexibility, Uniformity, Resource utilization, Social scientists.

The author discusses the present state of the planning industry in such widely diverse areas as traffic congestion, urban sprawl, water and air pollution, and outdoor recreation. The goal of all these planners is environmental quality, and the author suggests a need for some type of comprehensive environmental planning to organize these various planners and goals. Three major aspects of such comprehensive planning are discussed. First is the scope and content of such planning. The need for flexibility is pointed out, and defended by study of the river basin plan. The article also notes that complete environmental control is neither possible nor desirable. The second major problem concerns who will perform comprehensive planning. The author proposes either a group of well-rounded 'superplanners' or a group composed of experts from individual fields. Finally, the author discusses when comprehensive planning may become a reality. He suggests that the water resources field has provided good examples of what (or what not) to do since the 1930's. This experience provides significant assistance to present day comprehensive planners. (Murphy-Rutgers)
W71-00748

THE EFFICIENT PRODUCTION OF EXTERNAL ECONOMIES,
Maryland Univ. College Park; and Harvard Univ., Cambridge, Mass.
Mancur Olson, and Richard Zuckhauser.
American Economic Review Vol LX, No 3, p 512-517, June 1970.

Descriptors: *Welfare economics, *Economic evaluation, *Economies of scale, *Diseconomies of scale, *Spillovers, Cost minimization, Social aspects, Optimization, Resource allocation, Economic efficiency, Prices.
Identifiers: *Externalities, *Pareto optimality, Market adjustment, Collectivization.

External economies are often present in the water utility and hydroelectric power industries. This condition may yield the conclusion that regulation is necessary in order to achieve Pareto optimality. However, this conclusion has recently been rejected by some economists. This paper argues that the conclusion is valid and that those who do not agree have failed to understand that external economies are produced with different degrees of efficiency and that independent adjustment will generally lead to an inefficient level of output as well as an inefficient method of production. Thus, society is forced to pay more for the suboptimal supply of the good than it would have to pay for the larger amount which an ideal collective arrangement would provide. The paper concludes by presenting some theoretical and policy insights suggested by the analysis. (Murphy-Rutgers)
W71-00749

EXCLUSION COSTS, EXTERNAL ECONOMICS, AND MARKET FAILURE,
Manchester Univ. (England).
R. Millward.
Oxford Economic Papers Vol 22, No 1, p 25-38, March 1970.

Descriptors: *Costs, *Benefits, *Economic efficiency, *Welfare economics, Production, Prices, Equilibrium, Joint costs, Demand, Economies of scale, Maximization, Model studies.
Identifiers: *Exclusion costs, *Public goods, *Externalities, Pareto efficiency.

The author seeks to examine the role of the exclusion principle in the explanation of external economics. A static social welfare maximization model is presented and the reasons why the circumstances of either increasing returns to scale or the presence of externalities precludes achievement of a welfare optimum are explained. The relationship between externalities and joint supply are explored and a distinction made between production costs and exclusion costs. To the extent that all marketed goods and services involve some exclusion costs, then efficient solutions are never attainable by market system. Only an economy ruled by a dictator, with complete knowledge of consumer preferences, could achieve the best solution. The exclusion problem is clearly present in the water resources area. The principles discussed in this paper should provide the planner of public water resource investments with a theoretical framework in order to evaluate the exclusion problems involved with certain uses of water (e.g. outdoor recreation). (Murphy-Rutgers)
W71-00750

THE ABANDONMENT DECISION UNDER UNCERTAINTY,
Norwegian School of Economics and Business Administration, Bergen.
Carl J. Nostrom.
Swedish Journal of Economics, Vol 72, No 2, p 124-129, June 1970.

Descriptors: *Risk, Optimality, Markov processes, Discount rate, Probability.
Identifiers: *Abandonment, Expected cash flow, Dynamic programming capital budgeting, Present value, Matrix.

The essential characteristic of the abandonment problem is that the decisions are made sequentially and under uncertainty. The author considers two approaches to this problem. The objective of the firm is to find a method which maximizes, at a given rate of discount, the expected present value of the total cash-flow resulting from the equipment to be abandoned. The Expected Cash-Flow (ECF) approach maximizes the present value of keeping and then selling equipment to satisfy optimality conditions. The author demonstrates the decision given by the ECF method is not optimal and leads to a tendency to sell too soon. The Dynamic Programming (DP) approach equals the expected value of equipment to abandonment time. This approach gives correct results but may not be feasible because of the complexity of the calculations. However, Markov programming may be helpful in some cases toward a solution. When the ECF decision is to keep the equipment, the DP decision is consistent. Thus, it is not necessary to know the optimal policy. This discussion may prove helpful to water planners concerned with capital budgeting. (Siegenthaler-Rutgers)
W71-00761

RESOURCE ALLOCATION AND THE REGULATED FIRM,
Bell Telephone Labs., Inc., Murray Hill, N.J. Data System Engineering Div.
Elizabeth E. Bailey, and John C. Malone.
Bell Journal of Economics and Management Science, Vol 1, No 1, p 129-142, Spring 1970.

Descriptors: *Resource allocation, Regulatory constraints, Capitalization.
Identifiers: *Regulated firm, Fair return on investment, Profit maximization, Monopoly firm, Mark-up, Lagrangian function.

The regulated firm is considered under a variety of management objectives and regulatory constraints to analyze the effects of the constraints and objectives on resource allocation. The alternative management objectives are profit maximization, sales maximization, return on investment and output. The regulatory constraints are fair return on investment, fair mark-up on costs, fair profit per unit production and fixed profit. The Lagrangian function for each objective is formulated subject to the constraints. The results indicate profit-maximizing firms subject to fair return investment overcapitalize with sales maximizing firms undercapitalizing. Companies subject to a fair return on investment use a nonminimum cost allocation of resources regardless of the management objectives used. Whether the fair return on investment is a management objective or a constraint, there is undercapitalization. The fair mark-up on costs and fixed profit constraints tend to encourage nonproductive resource use when demand is inelastic. The fair profit per unit production is the only constraint guaranteeing minimum cost operation by a profit or sales maximizing firm. This constraint results in efficient resource allocation and discourages the maintenance of nonproductive resources. This analysis is relevant for water planners concerned with economic efficiency in water utility management. (Siegenthaler-Rutgers)
W71-00762

CONSTRAINTS ON PUBLIC ACTION AND RULES FOR SOCIAL DECISION,
Princeton Univ., N.J.
David F. Bradford.
American Economic Review, Vol LX, No 4, p 642-654, September 1970.

Descriptors: *Decision-making, *Cost-benefit analysis, Welfare economics, Public investment, Rate of return, Constraint.
Identifiers: *Dorfman paradox, Social discount rate, Perpetuity value, Present value, Time preference.

This paper is concerned with an analysis of the Dorfman paradox and more generally the prescriptive forces of cost-benefit analysis. In his research on project-specific social discount rates, Robert Dorfman presents two formulas, one using present values and the other equivalent annual perpetuity streams to generate a social discount rate for use in public investment decision-making. Although the two formulas are symmetric, they yield different values for the social discount rate and lead to different social investment choices. This paradox arises because a competitive equilibrium does not hold in the production and distribution of dated goods or there is an imperfect capital market. For social decision-making, the effect on the income distribution must be considered along with the benefit-cost ratio calculation. For the Dorfman paradox, the appropriate social discount rate will hinge on the type of income transfers considered feasible or in other words, the constraints of social action. Thus, cost-benefit analysis is not adequate as a screening device because it does not give enough details on the gains and losses resulting

from an investment decision. This discussion is of interest to water projects employing a cost-benefit framework for decision-making. (Siegenthaler-Rutgers)
W71-00764

UNCERTAINTY AND THE EVALUATION OF PUBLIC INVESTMENT DECISIONS,
Harvard Univ., Cambridge, Mass.; and Stanford Univ., Palo Alto, Calif.
Kenneth J. Arrow, and Robert C. Lind.
American Economic Review, Vol LX, No 3, p 364-378, June 1970.

Descriptors: *Public investment, *Risk decision-making, Discount rate, Interest rate, Optimization.
Identifiers: *Expected return, Asset holding, Capital market, Pooling.

The authors take the position that risk should be discounted in the same way for public investment as it is for private investment. Using Hirshleifer's work as a basis, a state perference model approach is presented. The article, assuming perfect capital markets, demonstrates that the government should behave as an expected-value decision maker. In the absence of perfect markets, the author presents an approach where individual preferences are relevant for public investment decisions. The article also argues that when risks associated with public investment are publicly borne, the total cost of risk-bearing is insignificant. Thus, the government should ignore uncertainty in public investment evaluation. The discount rate chosen also should be independent of risk. These results are obtained because the government distributes the risk associated with any investment among a large number of people. This discussion is of interest to water research efforts concerned with the investment decision-making process. (Siegenthaler-Rutgers)
W71-00765

CAPITAL RATIONING AND EXTERNAL DISCOUNT RATES,
New York Univ., N.Y.
Edwin J. Elton.
Journal of Finance, Vol XXV, No 3, p 573-584, June 1970.

Descriptors: *Decision making, *Capital market, Linear programming, Market value, Constraint, Rate of return.
Identifiers: *Capital budgeting, *External discount rate, Capital rationing, Cash flow, Objective function, Transaction costs, Asset selection.

This paper contends that external discount rates are important to a firm operating under capital rationing. This position is contrary to previous research. Capital rationing occurs when the firm has no external borrowing opportunities, but the firm's stockholders do have access to capital markets. The author argues that the indifference utility curve for a stockholder depends on the market time or external discount rate for firms of the same risk. This is so because in capital rationing the lending and borrowing curve does not exist. He discusses mathematical programming models for a firm operating under capital rationing and demonstrates that the reinvestment rate depends on the objective function assumed. Since the market discount rate is the appropriate rate to discount cash flow from the firm, the market or external discount rate affects the project selection process. Although a firm may be unwilling to go to the capital market for new funds, the firm is still valued in the market: Thus, capital budgeting precriptions should not ignore the impact of the firm's capital budgeting decision on current market price. This article is relevant to capital budgeting and investment decisions in the water area. (Siegenthaler-Rutgers)
W71-00777

SURVEY OF CAPITAL BUDGETING: THEORY AND PRACTICE,
British Columbia Univ., Vancouver.
James C. T. Mao.
Journal of Finance, Papers and Proceedings, Vol XXV, No 2, p 349-360.

Descriptors: *Decision making, Optimization, Risk, Discount rate, Probability.
Identifiers: *Capital budgeting, Mathematical programming, Cash flow, Present value, Internal rate of return, Payback period, Accounting profit, Certainty equivalent approach.

Wide disparaty exists between the theory and practice of capital budgeting. The theory of optimal investment decisions is premised on the existence of an objective function which the firm maximizes. Current financial theory assumes the firm should maximize the market value of its common shares. The results of firm case studies conducted by the author are consistent with theory on the objective of financial management. In capital budgeting theory, risk is generally measured by the variance of investment return; however, the author suggests the use of semi variance because it is consistent with measurement of the opportunity cost of capital and the case study findings. Theory incorporates risk into investment analysis through either the certainty equivalent approach or the risk-adjusted discount rate method. In practice, firms incorporate risk through the risk-adjusted discount approach. While theorists recommend the internal rate of return or net present value criterion for investment appraisal, the study confirms the prevalence of the payback period and accounting profit criteria in practice. To make theory more operationally meaningful, the author suggests the development of a dynamic model of decision-making, accurate estimates of cash flow, and more stress on growth objectives. This article is relevant to water policy makers concerned with the investment decision process. (Siegenthaler-Rutgers)
W71-00778

THE PROSPECTIVE GROWTH RATE AS A MEASURE OF ACCEPTIBILITY OF A PROPOSAL,
Stanford Univ., Palo Alto, Calif.
R. V. Oakford.
Engineering Economist, Vol 15, No 4, p 207-216, Summer 1970.

Descriptors: *Decision-making, Capital investment interest rate.
Identifiers: *Capital growth rate, Cash flow series, Present worth, Benefit series.

The prospective capital growth rate in financial transactions is specified as an interest rate and is defined as the rate of growth of capital which remains invested in a proposal. If the proposal involves borrowing then the prospective growth rate is the rate at which the unpaid capital balance grows. The author shows that the use of the growth rate as a measure of the attractiveness of a proposal differs depending upon whether the project represents an increment of investment or borrowing. If cash flow represents an increment of investment, a decision-maker should invest if the capital growth rate is greater than the marginal growth rate. If however, the cash flow represents borrowing and the growth rate is larger than the marginal rate, the decision is to reject the increment of borrowing. If the cash flow does not fall into the above two categories, and the decision rule is inapplicable to the formal relationship between present worth and prospective growth rate. With proper application, the two decision criteria will yield the same results for project evaluation except when the cash flow series cannot be identified as an investment increment or borrowing increment. This discussion is relevant to water planners involved with project proposals. (Siegenthaler-Rutgers)
W71-00780

MORE ON THE SOCIAL RATE OF DISCOUNT,
North Carolina State Univ., Raleigh.
J. A. Seagraves.
Quarterly Journal of Economics, Vol LXXXIV, No 3, p 430-450, August 1970.

Descriptors: *Discount rate, *Investment, *Economic evaluation, *Risk, *Government, Taxes, Cost, Cost-benefit analysis, Maximization, Interest rate, Capital, Decision-making, Computers.
Identifiers: *Social rate of discount, *Rate of return, Opportunity cost, Inflation.

The author is concerned with the question of how a given level of investment should be allocated among projects. He interprets the social rate of discount as a minimum rate of return which government projects hould achieve. The selection of this rate of discount is often a difficult task in the evaluation of water resource investments and the provision, by this author, of practical economic criteria for selecting among investments, should be of particular interest to the water resource planner. He recommends the calculation of real internal rates of return and continual reranking of projects by individual agencies and the Bureau of the Budget. The social opportunity cost of capital is estimated by first using the yield on Class A Corporate bonds to represent the risk-free earnings of the private sector after taxes. A risk premium and a tax factor are then added and a factor subtracted for the lower rate earned on additional savings and the expected future rate of inflation. The discount rate controversy has important implications for water investment decisions. Accordingly, this article is relevant to the investment analyses of water resources. (Murphy-Rutgers)
W71-00782

RICHMOND REGIONAL WATER PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 06D.
W71-00804

RECOMMENDED REGIONAL PLAN FOR SEWERAGE, WATER SUPPLY AND STORM DRAINAGE.
Valley Regional Planning Agency, Ansonia, Conn.

Available from NTIS as PB-192 940, $3.00 in paper copy, $0.95 in microfiche. February 1970. 60 p. append. Illus. HUD Project Conn. P-103.
Identifiers: *Urban planning, *Connecticut, *Sanitary engineering, Urban areas, Sewage, Drainage, Floods, Control, Water supplies, *Regional planning and development, *Storm sewers, Water resources.

The report presents the recommended regional plan and program for sewerage, water supply and storm drainage for the 58 square mile Valley Planning Region, comprising Ansonia, Derby, Seymour, and Shelton, Connecticut. (See also W71-00820)
W71-00819

STORM DRAINAGE: INVENTORY AND ANALYSIS OF MAJOR EXISTING AND PLANNED FACILITIES. VOLUME V: STORM DRAINAGE.
Valley Regional Planning Agency, Ansonia, Conn.

Available from NTIS as PB-192 942, $3.00 in paper copy, $0.95 in microfiche. February 1970. 18 p. Diagr. Illus. HUD Project Conn. P-103.
Identifiers: *Urban planning, *Connecticut, *Drainage, Urban planning, Floods, Protection, Sewage, Sanitary engineering, *Regional planning and development, *Storm drainage, *Sewers.

The fifth of a five-volume report that is being utilized as part of the basis for an areawide water/sewer plan and program for the Valley Region. This volume includes an inventory and evaluation of the major existing and planned facilities. The inventory includes a delineation of present areas served by storm sewers and areas requiring flood protection. (See also W71-00819)
W71-00820

A MASTER WATER PLAN FOR UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 03D.
W71-00825

WATER SUPPLIES AND WATER FACILITIES IN UNION COUNTY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 03D.
W71-00826

SUSQUEHANNA RIVER BASIN STUDY--A REVIEW.
Susquehanna River Basin Study Coordinating Committee, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W71-00852

SECONDARY ECONOMIC IMPACT FROM WATER RESOURCES DEVELOPMENT, A CASE STUDY OF FLAMING GORGE RESERVOIR,
Utah State Univ, Logan.
Andrew Bacdayan, and R. S. Whaley.
Available from NTIS as PB-195 439, $3.00 in paper copy, $0.95 in microfiche. November, 1969. 4 p, 10 tab, 6 charts. Utah Resources Series 50. OWRR Project B-003-UTAH (1).

Descriptors: *Cost-benefit analysis, Reservoir sites, Attitudes, Utah, Wyoming, Behavior, *Benefits, Social aspects, Political aspects, Motivation.
Identifiers: Flaming Gorge Reservoir.

The study was limited to a descriptive analysis of the changes in the area surrounding Flaming Gorge. It resulted in several conclusions and recommendations: To study the impact of a project it is almost essential to wait until the new equilibrium has been reached. The downward trend in most of the economic indicators that resulted from the termination of construction activities at Flaming Gorge lasted about 3 years. The rates of increase in local government incomes and expenditures of the study area were substantially greater than for the rest of the state.
W71-00888

RECREATIONAL IMPACT OF RECLAMATION RESERVOIRS,
Denver Research Inst., Colo. Industrial Economics Div.
J. Gordon Milliken, and H. E. Mew, Jr.
Bureau of Reclamation, Department of Interior Summary Report, March 1969. 18 p, 4 fig, 14 photo, 4 ref.

Descriptors: *Recreation, *Reservoirs, Colorado, Economic impact, *Social impact, Recreation demand, Recreation facilities, Swimming, Boating, Camping Water skiing, Water sports, Fishing, Lakes, Multiple-purpose projects, Parks, Economics, Reservoir operation, Scenery, Soical aspects, Use rates.
Identifiers: Lake Granby (Colo), Shadow Mountain Lake (Colo), Horsetooth Reservoir (Colo).

The economic and social impacts of reservoir recreation were explored at three colorado reservoirs during 1968, about 20 years after their construction by the Bureau of Reclamation. Two of the reservoirs, Shadow Mountain Lake and Lake Granby, are adjacent to a scenic natural lake and near Rocky Mountain National Park, where they augment a pre-existing mountain resort area. The other reservoir, Horsetooth, is located at the edge of the foothills near a city of 40,000 persons. Horsetooth Reservoir brought new water-based recreation to a relatively arid part of northeastern Colorado. The study had two major purposes. First, to help improve understanding of some secondary economic and cultural effects of water development porjects, as contrasted to primary economic effects such as irrigated crop production and hydroelectric power generation. Second, to help provide a basis for better quantitative estimates of recreational values in determining the multiple benefits of projects. (Knapp-USGS)
W71-00893

A HYDROLOGIC INVENTORY SYSTEM,
State Univ. of New York, Binghamton. Dept. of Geology.
For primary bibliographic entry see Field 07A.
W71-01097

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

RISING WATER VALUES THAT RESULT FROM INCREASED MOBILITY,
Utah State Univ., Logan. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-00684

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
University of New England, Armidale (Australia). Dept. of Economic Statistics; and Guelph Univ. Dept. of Agricultural Economics.
J. W. B. Guise, and J. C. Flinn.
American Journal of Agricultural Economics, Vol 52, No 3, p 411-421, August 1970. 3 tab, 35 ref.

Descriptors: *Planning, *Water allocation (Policy), *Pricing, *Economic feasibility, *Water management (Applied), Semiarid climates, Irrigation districts, Irrigation efficiency, Irrigation programs, Water rates, Equilibrium prices, Unit costs, Value, Social impact, Competing uses, Competitive prices, Economic efficiency, Economic justification, Economic prediction, Model studies, Constraints, Equations, Water resources development, River basin development.
Identifiers: *Australia, *Econometrics.

Large scale water resources development involves the administration of diverse and often competing objectives. Efficiency and quality may be enhanced by the development of an econometric model from which optimal short-run allocation and pricing patterns may be derived. The most appropriate type of model is a competitive partial equilibrium framework using nonlinear programming and with the maximization of social payoff as the specified primary objective function. The degree of attainment of this primary objective would be limited by 2 types of constraint: (1) Political and legal (2) Physical and technical, involving the system of supply, storage and reticulation of water. Developed first was a finite horizon deterministic model for an intraseason situation involving competing demands from irrigation areas and a hydroelectric plant. Later, using empirical data, the model was applied to the Murumbidgee Irrigation Area of New South Wales. The mathematical model and the abstracted empirical data are described. From the solutions obtained, it was concluded that: (1) If resource misallocation is to be minimized, historically determined irrigation water prices are in urgent need of revision and (2) Shadow price information relevant to public policy formation may be generated by such a model. (Casey-Arizona)
W71-00688

POLLUTION, PURIFICATION AND THE THEORY OF EXTERNAL EFFECTS,
Stockholm Univ., Sweden.
Peter Bohm.
Swedish Journal of Economics, Vol 72, No 2, p 153-166, June 1970.

Descriptors: *Taxes, *Pollution, Marginal cost, Average costs, Profit, Feasibility.
Identifiers: *External effects, Net benefits, Connection costs.

This paper discusses the choice between taxation and centralized purification as a means of regulating pollution. External effects theory, indicates that efficient resource allocation is obtained by imposing a tax on polluters equal to the value of the marginal external effects. This solution results in an optimal level of pollution but doesn't yield positive net benefits. The tax approach may not be valid when the central purification alternative is feasible. When negative marginal external effects are present, the central purification solution is superior to taxation as long as the net benefits from purification are greater than those from taxation, and moreover the optimal marginal cost price for purification is below or above the tax and the external effects are increasing or decreasing. However, the purification scheme is not preferable to the above tax scheme in the case of a decreasing cost industry or when there are increasing negative marginal external effects. This article is of practical importance in providing theoretical guidelines for policy measures to reduce pollution. (Seigenthaler-Rutgers)
W71-00752

ECONOMIC EFFICIENCY IMPLICATIONS OF FEDERAL-LOCAL COST SHARING IN WATER RESOURCE DEVELOPMENT,
Economic Research Service, Washington, D.C.
Harold Emory Marshall.
Water Resources Research, Vol 6, No 3 p 673-682, June 1970.

Descriptors: *Economic efficiency, *Cost sharing, Cost-benefit analysis, Expenditures, Water resource development, Budget constraint.
Identifiers: *Association rule, Public good, User charge, National efficiency benefit, Social benefit, Social cost.

The exact relationship between existing federal cost sharing rules and their efficiency aspects and equity considerations with respect to water resource development are not clearly defined. The problem is whether present cost sharing rules have the effect of inducing local parties to maximize national efficiency benefits or to demand projects that maximize local interests. The Army Corps of Engineers, the Bureau of Reclamation, and the Soil Conservation Service who are involved with cost sharing rules have inconsistent policies and practices on this subject. These inconsistencies have enabled local groups to look for the lowest cost share and thus select production techniques that are socially inefficient. To remedy this situation, the article suggests the use of the association rule that costs be shared in the same proportion as benefits at the margin. Through the use of the association rules and consistent cost sharing rules, local groups can be induced to select socially efficient projects. More specifically, the introduction of higher local cost shares and user charges are mentioned. The implementation of these suggestions would lower social expenditure and result in higher local shares in water resource development. (Siegenthaler-Rutgers)
W71-00755

SOME BEHAVIORAL CHARACTERISTICS ASSOCIATED WITH RESIDENTIAL WATER PRICE CHANGES,
John Hopkins Univ., Baltimore, Md.
Steve H. Hanke.
Water Resources Research Vol 6, No 5, p 1383-1386, October 1970.

Descriptors: *Prices, *Water demand, *Measurement, *Instrumentation, *Sampling, Sprinkling, Domestic water, Social aspects, Economic evaluation, Planning, Time, Water conservation, Income, Water rates, Water management, Statistics.
Identifiers: *Boulder, Colorado, *Interviewing, Socioeconomic aspects.

In this report the author describes the specific types of changes that occurred in consumer behavior after incremental water prices were introduced in

Boulder, Colorado. Interviews were obtained from a random sample of 180 customers. The responses indicated that consumers modified their behavior to take account of the incremental charges. Conservation of water use also increased with time as consumers began to make substitutions and more efficient use of water. Socioeconomic characteristics were found to play a small part in determining attitudes toward meters and water. The author feels that these results enable water managers to more accurately predict behavioral adjustments to water price changes. (Murphy-Rutgers)
W71-00759

MARGINAL COST PRICING WITH JOINT COSTS,
Graduate Centre for Management Studies, Birmingham (England).
J. C. Littlechild.
Economic Journal, Vol LXXX, No 318, p 323-335, June 1970.

Descriptors: *Joint costs, Marginal costs, Demand function, Mathematical programming, Constraint optimality.
Identifiers: *Peak-load pricing, Cost minimization, Consumer surplus, Producer surplus, Joint product.

The author first considers Ralph Turvey's research on the problem of marginal cost pricing with joint products in the context of peak-load pricing. The author shows the optimal rules developed by Turvey can also be derived via programming methods. At optimality, the marginal cost of output in any period equals its marginal cost but the result is indeterminate in the case of equal outputs. The reason for the possible indeterminacy is that production over time is essentially a joint product of durable capital equipment. This is remedied by incorporating demand functions as well as costs into the analysis by maximizing the present value of the producer and consumer surplus subject to capacity constraints. The appendix demonstrates with a technology slightly different from Turvey's under certain conditions decision rules can be obtained whereby marginal cost in any period depends on the values of the parameters as given in that period only. This analysis is relevant for water studies concerned with pricing and investment decisions under uncertainty. (Siegenthaler-Rutgers)
W71-00763

THE PEAK-LOAD PROBLEM: DAVIDSON'S SOLUTION RECONSIDERED,
Georgia Univ., Athens.
Donald Ray Escarraz.
Quarterly Review of Economics and Business, Vol 10, No 2, p 85-90, Summer 1970.

Descriptors: *Peak load, Economic efficiency, Public utilities, Joint costs.
Identifiers: *Marginal cost pricing, Average cost, Plant capacity, Distributional equity.

The peak load problem is concerned with the establishment of utility rates which satisfy the criteria of economic efficiency and distributional equity. The author examines Ralph Davidson's work on this subject. Davidson's solution is to equate period price to long run marginal cost of the same period. The model is based on the concept that off-peak demand and peak demand exist for the same product in different markets with peak demand and peak costs in the primary market determining output and plant capacity. The author finds that the separate market assumption implies price discrimination between time periods because monopoly control prevents price equality. Furthermore, it is shown that Davidson's full cost assumption involves average and not marginal cost pricing. As an alternative, it is suggested the peak load problem might be studied from the view of joint costs and that plant capacity be determined by long run demand and short run supply. The existence of peak demand conditions for water make this article relevant to water research efforts concerned with pricing policies. (Siegenthaler-Rugers)
W71-00767

ON OFF-PEAK PRICING: AN ALTERNATIVE SOLUTION,
Pennsylvania Univ., Philadelphia.
Sidney Weintraub.
Kyklos, Vol XXIII, No 3, p 501-519, 1970.

Descriptors: *Peak load, Marginal costs, Average cost, Economic welfare.
Identifiers: Pareto optimal, User costs, Firm-peak, Free rider, Shifting-peak.

Oscillations in demand for public utility services make it difficullt to devise a rate structure for efficient use of facilities while maintaining pricing equity among different users. This phenomenon is known as the peak-off-peak (P-O-P) pricing problem. The varying prices are attributable to heavy capital costs and relatively unimportant user costs. The author examines Steiner's work on the P-O-P problem. Steiner distinguishes between two cases in his analysis; first a shifting peak where output is uniform at both times but price varies and secondly, a firm peak where prices at peak cover full costs but at off peak, the price is zero. The shifting peak case is criticized because shifting prices violate the Pareto optimal rule since price is not equal to marginal cost. The firm peak case involves free riders because output is free to off-peak users, a result which may be unsatisfactory on equity grounds. An alternative suggested by the author is a pricing policy which maximizes the sum of peak plus off-peak output so this results in a benefit to both groups. This article is of interest to water utility administrators concerned with pricing policy. (Siegenthaler-Rutgers)
W71-00768

THE PEAK LOAD PROBLEM WITH INCREASING RETURNS AND PRICING CONSTRAINTS,
Minnesota Univ., Minneapolis.
Herb Mohring.
American Economic Review, Vol LX, No 4, p 693-705, September 1970.

Descriptors: *Peak load, Resource allocation, Marginal cost, Constraint.
Identifiers: *Social welfare function, Objective function, Scale economies, Quasi-rents.

The variation on the demand for services rendered by public utilities is the subject of this paper. The author shows that the rules for efficient allocation of resources used in the production of peak load commodities are same as those for commodities not subject to short run variations in demand. For both types of commodities, the revenues derived from marginal cost prices will just equal total costs, if and only if, production is characterized by constant returns to scale. In practice, the pricing and investment policies for producing peak load commodities violate the rules for efficient resource allocation. The author develops optimization rules for situations in which one or a combination of pricing restrictions are imposed on government agencies providing a public utility service. First, a deficit constraint is imposed on the production of the public utility service with the result that optimization no longer yields price equal to marginal cost. Next, the deficit constraint and a single price constraint are imposed on the model, with results that revenues no longer equal costs. Finally, the single toll constraint yields a inequality between prices and marginal costs. This analysis is relevant to water planners concerned pricing policies. (Siegenthaler-Rutgers)
W71-00769

SHORT-RUN COST FUNCTIONS OF A MULTI-PRODUCT FIRM,
Pennsylvania State Univ., University Park.
Ronald S. Koot, and David A. Walker.
Journal of Industrial Economics, Vol XVIII, No 2, p 118-128, April 1970.

Descriptors: *Cost function, Marginal cost, Linear programming, Constraint, Least squares regression analysis.
Identifiers: Multi-product, Full capacity, Quadratic, Autocorrelation.

In economic theory, the short run average and marginal cost curves of a firm are U-shaped according to the principle of diminishing returns. Empirically the U-shape is only one hypothesis of the form of the cost function. In this paper, linear, quadratic, and cubic cost functions are tested for a multi-product manufacturing firm using the method of single equation least squares. The results indicate that the short-run total cost functions are linear for each product and for the firm as a whole. The implication is that marginal and average variable costs are constant over the observed range of putputs. The linearity of the total cost function makes it possible to construct linear programming models and decision models. The techniques of this paper have relevance to empirical cost studies of water supply conditions. (Siegenthaler-Rutgers)
W71-00779

THE THEORY OF PUBLIC UTILITY PRICING AND ITS APPLICATION,
Chicago Univ., Ill.
Ronald Coase.
Bell Journal of Economics and Management Science, Vol 1, No 1, p 113-128, Spring 1970.

Descriptors: *Public utility pricing, Marginal cost, Average costs.
Identifiers: *Multipart pricing, Subsidy.

The use of marginal cost pricing is considered as a solution to the public utility pricing problem. Marginal cost pricing implies prices should be made equal to marginal costs even where marginal cost is less than average cost with government subsidies used to maintain production. Problems with this criterion are, first, it promotes the growth of state enterprises over the private sector. Second, the rule tends to redistribute income toward consumers of subsidized products. Third, there is a resource misallocation which results from taxation necessitated by the subsidies. The author auggests the need to examine the total effect of a policy proposal. The stress the role of costs in price determination, he considers a government regulatory decision. The cost to the common carrier of providing services to private industry are the additional costs of the service compared with the total cost incurred if no service was provided. Of importance for decision making are the present and future additional costs and not the historical ones. The regulated firm in competitive situation must respond on the basis of the alternative cost to achieve economic efficiency and survival. This discussion should prove relevant to water area studies concerned with pricing decisions. (Siegenthaler-Rutgers)
W71-00781

ESTIMATION OF FIRST ROUND AND SELECTED SUBSEQUENT INCOME EFFECTS OF WATER RESOURCES INVESTMENT,
Chicago Univ., Ill. Dept. of Economics.
George S. Tolley, V. S. Hastings, Adnan Z. Daghestani, Robert Rugg, and Shaul Ben-David.
Available from NTIS as AD-708 925, $3.00 paper copy, $0.95 in microfiche. Final Report February 1970, 256 p. Army Engineers Institute for Water Resources, IWR 70-1. Contract DA-49-12 CIVENG-65-11.
Identifiers: *Economics, Water supplies, *Natural resources, Management planning, Recreation, Employment, Statistical data, Wages, Abundance, Regression analysis, Mathematical models, Population, Investments, Benefit cost analysis, National income, Population migrations.

The publication presents research leading to methodology for estimating the first-round local

ects related to the change in the availability of vater for supply purposes or recreation. It develops stimates of demand for reservoir recreation, and stimates the change in structural unemployment esulting from changes in output. It evaluates the ifferences in regional multiplier values, proposes a efinement in regional multiplier estimates, and in-egrates the various research papers, presenting a ase for the selected strategy for estimating those ational income benefits to water resource evelopment in excess of direct output valued in erms of the users 'willingness to pay.'
V71-00799

5D. Water Demand

EMAND FOR WATER UNDER DYNAMIC ONDITIONS,
ohn Hopkins Univ., Baltimore, Md.
teve H. Hanke.
Vater Resources Research Vol 6, No 5, p 1253-261, October 1970.

escriptors: *Water demand, *Prices, *Water ates, *Measurement, *Instrumentation, Time se-es, Economic evaluation, Equilibrium, Forecast-g, Domestic water, Sprinkling, Regression analy-s, Model study, Planning.
dentifiers: *Metering, *Dynamic analysis, Boulder Colorado.

his paper attempts to estimate the demand for re-dential water in Boulder, Colorado, under dynam- conditions. It presents an empirical analysis of e effects of changing from a flat rate price struc-re to a metered one for the purpose of establish-g an equilibrium in the water market through anges in demand. The study provides an empiri-l test to determine whether the demand curves r residential water use are negatively sloped and nform to the standard postulates of demand eory. Time series data were used and residential emand broken down into the categories of omestic and sprinkling consumption. The quanti-es of both types of water demanded were signifi-antly reduced by the introduction of a commodity harge and continued to remain at this lower level. he author concludes that pricing policies must be ken into account in forecasting future water de-ands. (Murphy-Rutgers)
V71-00758

EGIONAL WATER PLAN, PART I.
eart of Texas Council of Governments, Waco.

vailable from the NTIS as PB 192 706, $3.00 in aper copy, $0.95 in microfiche. May 1970, 55 p.
dentifiers: *Management planning, Water sup-ies, *Water supplies, *Texas, Population, olume, Terrain, Surface properties, Drainage, tatistical data, Terrain, Selection, Storage, Dams, ources, Industries, Water use, Regional planning, ater storage, Groundwater.

he report includes the findings of the Heart of exas Council of Governments Regional Water lan, Part I. The plan has been undertaken to certain the water demands by the year 1985. Pri-ary considerations in the plan design were that etermination of total water demands, per capital nsumption rates, industrial and commercial de-ands and the spatial distribution of water require-ents across the planning area.
V71-00794

ICHMOND REGIONAL WATER PLAN. AREA VIDE PLAN FOR LONG RANGE DEVELOP-IENT.
ichmond Regional Planning District Commission, a.

vailable from NTIS as PB-192 442, $3.00 in aper copy, $0.95 in microfiche. April 1970, vari-us pagings. HUD Project Va. P-42.

Identifiers: *Urban areas, Water supplies, *Water supplies, *Management planning, Data, Volume, Sources, Civil engineering, Virginia, *Regional planning and development, Richmond, Virginia, Water consumption, Water services.

The volume consists of tabulated water demands by demand zones and other supplementary technical data pertinent to the basic report.
W71-00804

RICHMOND REGIONAL SEWERAGE PLAN. AREA WIDE PLAN FOR LONG RANGE DEVELOPMENT, TECHNICAL DATA.
Richmond Regional Planning District Commission, Va.
For primary bibliographic entry see Field 05G.
W71-00805

VERMONT SHADE ROLLER CO V BURLINGTON TRACTION CO (MEASUREMENT OF USE OF INDUSTRIAL WATER).
For primary bibliographic entry see Field 06E.
W71-00878

CONSUMPTIVE USE OF IRRIGATION WATER IN WYOMING,
Wyoming Univ., Laramie. Water Resources Research Inst.
For primary bibliographic entry see Field 03F.
W71-00901

QUANTITATIVE ANALYSIS OF INDUSTRIAL WATER-USE PATTERNS IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Ausberto Guilbe.
Available from NTIS as PB-195 639, $3.00 in paper copy, $0.95 in Microfiche. University of Puerto Rico Water Resources Research Institute Report, June 1970. 58 p, 15 fig, 38 tab, 7 ref, append. OWRR Project A-003-PR (3).

Descriptors: *Water utilization, *Waste water disposal, *Waste treatment, *Industrial water, Puerto Rico, Water reuse, Water quality, Water treatment, Water sources, Surveys.
Identifiers: Industrial water use (Puerto Rico).

Water-use characteristics of a sample of factories were studied in several parts of Puerto Rico. The factories belong to the metal, chemical-petrochemical, pulp-paper, and food processing classifications. A questionnaire was employed for this purpose. The two main sources of water intake reported were public utilities and deep wells. Only 32% of the plants reported treating intake water. Cooling, production and distribution of heat and power, and incorporation into product ranked highest of all water uses. Only 20% of the factories reported using evaporative type air cooling systems. Forty one percent reported practicing water reuse. The municipal sewer system, underground disposals, and the ocean ranked highest of all waste water receiving bodies. Sedimentation and neutralization were the most frequently reported waste water treatments. (Knapp-USGS)
W71-00902

6E. Water Law and Institutions

ERIE RR V STATE TAX COMM'N (TAXATION OF RAILROAD BRIDGE OVER A NAVIGABLE RIVER).

293 NY 900, 60 NE2d 31 (1944).

Descriptors: *New York, *Railroads, *Bridges, *Assessments, Canals, Navigation, Taxes, Dams, Navigable rivers, Transportation, Navigable waters, Non-navigable waters, Judicial decisions, Legal aspects, Evaluation, State governments, Legislation.

Plaintiff railroad company sought judicial review of franchise assessments levied by defendant state tax commission on a railroad bridge over a river. Plaintiff contended that the river was not navigable at the crossing point and therefore the bridge was not subject to the tax. Defendant argued that the river was navigable since it had been dammed and canalized, was referred to in the local city directory as navigable, and was designated a public highway by several state statutes. A judgment for defendant was affirmed per curiam. (Liptak-Florida)
W71-00602

COMM'R OF PUBLIC WORKS V CITIES SERVICE OIL CO (REVOCATION OF PERMIT TO MAINTAIN PIER IN TIDAL WATERS).
32 NE2d 277-286 (Mass 1941).

Descriptors: *Massachusetts, *Piers, *Tidal waters, *Regulation, Judicial decisions, Legal aspects, Riparian rights, Access routes, Right-of-way, Permits, Legislation, State governments, Administrative agencies, Navigable waters, Docks, Coastal structures, Riparian waters, Usufructuary right, Prescriptive rights, Riparian land, Oil industry, Supervisory control (Power).

Plaintiff commissioner of public works sued defendant oil company to compel removal of a pier and dolphins that had been erected by defendant over state tidewater under license from the public works department. Plaintiff contended that both the law and the license provided that the right to maintain the structures over state waters was revocable and, upon notice, the structures had to be removed. Defendant argued that the license law exempted valuable structures from the revocation provisions and that the revocation of the permit would impair its riparian right of access to navigable water. Affirming a judgment for plaintiff, the court held that defendant had applied for, and received, a temporary license and could not complain of terms it agreed to upon acceptance of the license. The court also noted that the exemption of valuable structures from the automatic expiration provisions did not extend to plaintiff's discretionary power to revoke. The court did not reach defendant's last contention since the structures were not erected pursuant to defendant's riparian rights but solely on the authority of the license law. (Liptak-Florida)
W71-00603

NORTHERN NEW YORK POWER CORP V STATE (RIPARIAN RIGHT TO SURPLUS WATER FROM LOCK AND CANAL OPERATION).
293 NY 756, 57 NE2d 837 (1944).

Descriptors: *Water rights, *New York, *Riparian rights, *Appropriation, Canals, Locks, Dams, Riparian land, Water supply, Alteration of flow, Riparian waters, Compensation, Damages, Value, State governments, Legal aspects, Judicial decisions, Preferences (Water rights), Inland waterways, Navigation, Gates.

Plaintiff power company brought action against defendant State of New York to recover for water rights appropriated for the construction and maintenance of certain dams and locks. Plaintiff contended that as a riparian owner it was entitled to all surplus water in excess of that required by defendant for the maintenance of the canal and for proper navigation. Defendant argued, as had been established by earlier decision, that plaintiff's water rights were limited to the amount of water flowing through certain openings in one of the dams. A judgment for plaintiff was affirmed per curiam. (Liptak-Florida)
W71-00604

BERT V CITY OF ALLIANCE (CITY'S LIABILITY FOR POLLUTION OF RIVER BY SEWAGE TREATMENT PLANT).
32 NE2d 49-51 (Ohio Ct App 1936).

Descriptors: *Ohio, *Water pollution, *Odor, *Sewage treatment, Pollution abatement, Riparian rights, Riparian land, Water pollution effects, Municipal wastes, Sewage, Sewage effluents, Sewage sludge, Sludge disposal, Waste disposal, Rivers, Waste water (Pollution), Cities, Local governments, Judicial decision, Legal aspects, Adjudication procedure, Remedies.

Plaintiff landowner sought damages and an injunction to restrain the emission of noxious odors from defendant's sewage treatment plant and the discharge of sludge from such plant into a river which ran through plaintiff's farm. Plaintiff contended that defendant's activity constituted a nuisance and injured his enjoyment of his property. Defendant argued that the river was polluted before it reached the sewage treatment plant and that there were no odors emanating from the plant. Affirming the judgment for defendant, the court held that the conflicting evidence of the existence and origin of any pollution and odors was properly submitted to the jury, and the evidence fully supported their finding for defendant. (Liptak-Florida)
W71-00609

SMITH V WATERWORKS BD (CONSTITUTIONALITY OF WATER WORKS INDEBTEDNESS).
175 So 380-383 (Ala 1937).

Descriptors: *Alabama, *Waterworks, *Debt, *Cities, Water supply, Public health, Community development, Cost repayment, Loans, Interest, Public utilities, Judicial decisions, Legal aspects, Municipal water, Water costs, Water conveyance, Water delivery, Financing, Legislation.
Identifiers: *Constitutionality.

Plaintiff taxpayer sought to enjoin incorporation of defendant city's waterworks. The city planned to incorporate its waterworks and to issue bonds to build waterworks facilities. The bonds would be secured by mortgaging and pledging future earnings from such facilities. An Alabama general act authorized this type of financing without a general election for taxpayer approval, since tax revenues would not be utilized to pay the debt. The act declared that a debt thus created would not be a municipal debt. Plaintiff contended that the city would be liable for the debt thus established without taxpayer approval, in violation of the Alabama constitution. In holding for defendant, the court reasoned that a mortgage or pledge from an already-existing, city-owned facility would be a prohibited municipal debt if given without voter approval, but a pledge or mortgage upon facilities to be constructed with the borrowed funds would be solely a debt of the waterworks board. (Hart-Florida)
W71-00610

STATE V BD OF COMM'RS OF CADDO LEVEE DISTRICT (OWNERSHIP OF BEDS OF NONNAVIGABLE WATERS).

188 La 1, 175 So 678-688 (1937).

Descriptors: *Ownership of beds, *Bodies of water, *Louisiana, *Administrative agencies, Levees, Management, Judicial decisions, Legal aspects, Regulation, Administration, Legislation, Projects, Navigable waters, Lakes, Bayous, Streams, State governments, Prior appropriation, Water resources development, Water allocation (Policy), Land tenure, Non-navigable waters.

Louisiana state officials certified and transferred the bed of a non-navigable portion of a bayou to defendant levee board pursuant to an act which granted lands within the levee district to the levee boards. Prior to the certification and transfer, a Louisiana statute was passed which declared the state to be the owner of waters and beds of all bayous, lagoons, lakes, rivers and bays except those under direct private ownership and those transferred as directed by law to a levee board. Plaintiff state and defendant both claimed ownership of the bed of the bayou. The Louisiana supreme court held for plaintiff, concluding that the grant to defendant was repealed by the statute declaring the state as owner of waters and beds of streams such as the land in question. The court determined that the exception clause of the repealing statute referred to private owners of waters and beds and not to the several levee boards whose rights, privileges, and obligations are at all times under legislative control. (Powell-Florida)
W71-00611

HOWELL V CITY OF DOTHAN (ABATEMENT OF NUISANCE CAUSED BY MUNICIPAL WASTES).
174 Sc 624-630 (Ala 1937).

Descriptors: *Alabama, *Pollution abatement, *Sewage, *Water pollution, Cities, Judicial decisions, Legal aspects, Municipal wastes, Riparian rights, Watercourses (Legal), Water rights, Streams, Odor, Damages, Local governments, Sewage disposal, Remedies.

Plaintiff landowner brought action against defendant municipality to abate a nuisance caused by the overflow, diversion and discharge of sewage into a creek adjoining plaintiff's land. Plaintiff also sought damages for the loss of stock due to pollution of the creek and for permanent injuries to his land. The Supreme Court of Alabama affirmed the lower court decree awarding an injunction to plaintiff but denying recovery of damages. The court held that the plaintiff landowner was not entitled to a judgment against defendant for injuries and damage to his land because the evidence was not sufficient as to time of destruction of the timber and of deterioration of the cultivatable land so as to warrant recovery. (Powell-Florida)
W71-00638

WHITE V HUGHES (RELATIVE RIGHTS OF MOTORISTS AND BATHERS TO UTILIZE BEACH).
190 So 446-454 (Fla 1939).

Descriptors: *Florida, *Beaches, *Swimming, *Scenic highways, Atlantic Ocean, Highways, Legal aspects, Judicial decisions, Adjudication procedure, Safety, Scenery, Accidents, Hazards, Legislation, Riparian rights, Competing uses, Relative rights, Riparian land, High water mark, Low water mark, State jurisdiction, Boundaries (Property), Access routes, Public rights.

Plaintiff bather sought damages from defendant motorist for injuries sustained when defendant's vehicle struck him while plaintiff was sitting on the beach. The court held that the right of bathers to use the beach was superior to that of motorists and ruled that: (1) a riparian owner has common rights of access to the adjacent waters in common with the general public, subject to lawful state and federal legislation; (2) the beach of the Atlantic Ocean between high and low water mark is state property, held in trust for all the people; and (3) the state, in the interest of the general welfare, had lawfully designated the Atlantic beach as a public highway, but the authorization to use the beach as a highway was subject to its long-established reasonable use for bathing, recreation and navigation. (Hart-Florida)
W71-00640

MCCLUSKEY V MERAUX AND NUNEZ, INC (NAVIGABILITY OF STREAM).
186 So 117-121 (La 1939).

Descriptors: *Louisiana, *Navigable rivers, *Ownership of beds, *Prescriptive rights, Boundaries (Property), River beds, Non-navigable waters, Legal aspects, Judicial decisions, Adjudication procedure, Reservation doctrine, Streambeds, Streams, Beds under water, Boundary disputes, Navigable waters, Land tenure.

Plaintiff landowner brought action to quiet title to property claimed by defendant by prescription. The land in question was separated from defendant's land by a stream. Plaintiff contended that since the stream was navigable, the title to its bed was in the state, and therefore defendant's prescription could not have included the property in question. Defendant contended that the stream was nonnavigable, and consequently his prescriptive title extended across the stream to the land in question. The court found that the burden of proving navigability or non-navigability rested upon the party to whose advantage it would be to establish the fact. The court stated that: (1) where a stream was navigable when a state was admitted to the Union, the streambed became state property by virtue of its sovereignty; and (2) a stream is navigable in law when navigable in fact. Both parties had presented directly contradictory evidence on the width and depth of the stream as of the data Louisiana was admitted to the Union. Since defendant's evidence of non-navigability was strongly controverted, the court held that defendant had not acquired prescriptive rights in the property. (Hart-Florida)
W71-00641

CITY OF MERIDIAN V PEAVY (OBSTRUCTION OF FLOW IN CULVERT).
194 So 595-596 (Miss 1940).

Descriptors: *Mississippi, *Culverts, *Damages, *Adjudication procedure, Condemnation, Sewers, Storm runoff, Excess water (Soils), Floodwater, Rainfall disposition, Rainfall intensity, Water injury, Rainfall-runoff relationships, Flood damage, Overflow, Storm drains, Judicial decisions, Legal aspects, Cities, Impoundments, Obstruction to flow.

Plaintiff landowner sued defendant city for damages to realty and personality caused by water backing up over a plugged culvert. Defendant had installed a sewer pipe within the culvert, causing it to clog with sand and debris and impounding water which overflowed plaintiff's property. The overflowing water caused the pillars in plaintiff's residence to sink and destroyed his garden five times in one season. All contentions and evidence at the trial were based upon defendant's negligence in maintaining the culvert, but plaintiff obtained a jury instruction for the jury to find for plaintiff unless unprecedented rainfall caused the damage. The court found that this instruction pre-empted the issue of negligence, so that the jury's findings on the uncontroverted issue of rainfall would control the verdict. Plaintiff sought to sustain the instruction under a constitutional provision which entitled him to damages for inverse condemnation. In holding that the jury instruction was erroneous, the court reasoned that the defenses available for a condemnation action were entirely different from those for negligence, and held that plaintiff could not recover under a theory neither raised in the pleadings nor proved at the trial. (Hart-Florida)
W71-00663

RISING WATER VALUES THAT RESULT FROM INCREASED MOBILITY,
Utah State Univ., Logan. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-00684

CITY OF LAKELAND V DOUGLASS (MUNICIPALITY'S POLLUTION OF LAKE A NUISANCE).

197 So 467-470 (Fla 1940).

Descriptors: *Florida, *Water pollution, *Damages, *Municipal wastes, Adjudication procedure, Public health, Sewers, Sewage, Sewage disposal, Water pollution sources, Mosquitoes, Minnows, Water pollution effects, Pollutants, Fish kill, Odor, Carriers, Intermediate hosts, Judicial decisions, Legal aspects, Cities, Local gover

nents, Remedies, Lakes, Riparian rights, Riparian and.
dentifiers: *Nuisance.

Plaintiff littoral landowner brought action against defendant city for damages from pollution. Defendant turned raw city sewage into a canal which ran nto a lake upon which plaintiff's property bordered. The canal and lake were severely polluted, iving off noxious odors, destroying mosquito-larae eating minnows, and contaminating the lake. Plaintiff claimed loss of the use and enjoyment of is property and injury from malaria caused by the roliferation of mosquitoes. Defendant appealed he trial court's judgment for plaintiff. In affirming, he court found that the pollution was a nuisance or which the municipality was liable in damages. lowever, the court declared that plaintiff's laimed injury from loss of employment from alaria was too speculative to be allowed as a basis or damages from defendant. (Hart-Florida)
V71-00713

THE PAN-AM (OIL POLLUTION BY OIL TANKER IN COASTAL WATERS).

48 F2d 925-927 (3rd Cir 1945).

Descriptors: *Water pollution, *Legislation, Ships, *Damages, Water pollution sources, Pollutants, Oil, Navigable waters, Admiralty, Waves (Water), Ocean waves, Winds, Weather, Wind elocity, Judicial decisions, Legal aspects, Seepage, Oily water.
dentifiers: *Oil Pollution Act.

Plaintiff United States filed a libel against defendant oil tanker for discharge of oil in violation of he Oil Pollution Act. The vessel had discharged oil nto the coastal navigable waters of the United tates. Defendant answered that the vessel had encountered strong winds which strained the vessel nd caused the seepage, and therefore the oil eepage was unavoidable and caused by an emergency. The court found that no willingness or intent o discharge oil, nor overt act were required to impose liability under the Act; however, the Act was ound to excuse liability if seepage was a result of n emergency or unavoidable accident, collision or tranding. The evidence revealed that the weather nd sea conditions encountered were not severe, nd the vessel had received certificates of eaworthiness just prior to the voyage in question. Holding that the evidence did not support a finding f unavoidable accident under the Act, the court ffirmed the judgment for plaintiff. (Hart-Florida)
V71-00716

WISCONSIN PUB SERV CORP V FEDERAL POWER COMM'N (HYDROELECTRIC PROJECT LICENSING).

47 F2d 743-749 (7th Cir 1945).

Descriptors: *Wisconsin, *Navigable rivers, Hydroelectric project licensing, *Federal Power ct, Hydroelectric power, Hydroelectric plants, Navigation, Non-navigable waters, Lumbering, Interstate rivers, Judicial decisions, Legal aspects, Dams, Rivers, River regulation, Legislation, Administrative agencies, Administrative decisions, Supervisory control (Power), Permits.

Plaintiff corporation brought action against defendant commission to set aside defendant's order for laintiff to apply for a license under the Federal ower Act before operating a hydroelectric project n the Wisconsin River. Defendant contended that he Wisconsin River was navigable, and therefore laintiff was required to obtain a license to operate he project. Plaintiff contended the river was nonavigable because of obstruction. Defendant roved that the river was extensively used for transortation of logs in interstate commerce from 1858 o 1907. Plaintiff contended that use for logging nd rafting was insufficient for navigability. The ourt defined navigability in law as navigability in fact, noting that a river is navigable in fact when it is susceptible to use as a highway for commerce. The court stated further that: (1) log floating in continuous movement between states is interstate commerce; (2) absence of use over a long period becaused of changed conditions does not affect navigability; (3) once navigable, a waterway remains so; and (4) the ultimate finding of navigability is a factual question. On this basis the court concluded that the Wisconsin River was navigable. Plaintiff's further assertions that the logging operations were intrastate and that defendant's order ultra vires were rejected, and the court affirmed defendant's order. (Hart-Florida)
W71-00717

PENNSYLVANIA WATER AND POWER CO. V FEDERAL POWER COMM'N (HYDROELECTRIC PROJECT LICENSING).
123 F2d 155-163 (DC Cir 1941).

Descriptors: *Pennsylvania, *Navigable rivers, *Hydroelectric project licensing, *Federal Power Act, Hydroelectric power, Hydroelectric plants, Navigation, Non-navigable waters, Interstate rivers, Judicial decisions, Legal aspects, Dams, Rivers, River regulation, Legislation, Administrative agencies, Administrative decisions, Regulation, Permits, Supervisory control (Power).

Plaintiff power company brought action to set aside defendant commission's order to apply for a license to operate its hydroelectric project on the Susquehanna River. Plaintiff asserted that the river was non-navigable, but further asserted that if it was navigable, the dam was still lawful since it was erected with congressional consent prior to enactment of the Federal Power Act, which had only prospective application. In holding the Susquehanna to be navigable, the court stated that a river is navigable in law when it is navigable in fact, and when a river, with reasonable expenditure, may be made navigable, then it is navigable in fact. Finding that reasonable efforts would render the Susquehanna navigable, the court affirmed defendant's order. The court rejected plaintiff's contention that the dam was lawful notwithstanding navigability, noting that a congressional grant was not binding upon future Congresses, and that the language of the Federal Power Act indicated an intent to give it retrospective application. (Hart-Florida)
W71-00718

GOUAX V BOVAY (PAYMENT OF TOLL BY UNITED STATES FOR USE OF INTERSTATE TOLL BRIDGE).
105 F2d 256-259 (5th Cir 1939).

Descriptors: *Mississippi, *Louisiana, *Bridges, *Payment, Bridge construction, Cost sharing, Legislation, Rivers, Mississippi River, Navigable rivers, Highways, Federal government, United States, Legal aspects, Judicial decisions, Administrative agencies, Interstate.
Identifiers: *Constitutionality.

Plaintiff army officer sought repayment of tolls paid for movement of federal troops and vehicles across a Mississippi River bridge owned by defendant bridge company. Plaintiff contended that under the Bridge Act, no tolls were payable. Defendant asserted that the Bridge Act and cngresssional authorization expressly permitted tolls. The court noted that since the bridge was interstate, Congress might regulate the tolls. The erection of any bridge over navigable waters not lying wholly within one state requires congressional consent. However, the court found that where Congress had given no special aid to the enterprise, free use by the United States would not be assumed. After pointing out that where the United States had assisted construction of such bridges, immunity from tolls had often been expressly stipulated, the court concluded that immunity from toll for plaintiff would amount to taking property without conpensation, and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-00725

A MODEL OF OPTIMUM WATER ALLOCATION UNDER IOWA'S PERMIT SYSTEM,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 06A.
W71-00730

THE NORTHEAST OHIO WATER DEVELOPMENT PLAN PROGRAM FOR ACTION,
Ohio Dept. of Natural Resources, Columbus; and Stanley Consultant, Cleveland, Ohio.
For primary bibliographic entry see Field 06B.
W71-00740

HEGGLUND V UNITED STATES (CRIMINAL PROSECUTION FOR DISCHARGE OF OIL INTO NAVIGABLE WATERS).

100 F2d 68-71 (5th Cir 1938).

Descriptors: *Louisiana, *United States, *Oily water, *Water pollution, Path of pollutants, Pollution abatement, Pollutants, Water pollution sources, Oil wastes, Ships, Navigable waters, Leakage, Legislation, Remedies, Judicial decisions, Legal aspects, Oil, Oil industry.

Defendant was convicted of violating a federal statute which forbade the discharge of oil by a ship into coastal navigable waters of the United States. On appeal, he argued that the statute contemplated only an intentional discharge and that his action was unintentional and came within the statutory exception covering such discharges in cases of unavoidable accidents. The United States Circuit Court of Appeals, Fifth Circuit, ruled that the act was designed to cover unintentional as well as intentional discharge and that the fact that defendant knew his ship to be leaky was sufficient to take the case out of the unavoidable accident exception of the statute. The conviction was affirmed. (Barker-Florida)
W71-00741

LAKEWOOD SS CO V SUPERIOR WATER, LIGHT AND POWER CO (DAMAGE TO UNDERWATER WATER MAIN).
88 F2d 895-899 (7th Cir 1937).

Descriptors: *Wisconsin, *United States, *Damages, *Conduits, Metal pipes, Pipes, Water conveyance, Navigable waters, Bays, Legislation, Governments, Ships, Anchors, Pumping, Pumps, Pumping plants, Remedies, Judicial decisions, Legal aspects, Piping systems (Mechanical), Navigation.

Plaintiff operated a water main beneath the waters of a bay between Wisconsin and Minnesota. Defendant steamship company's ship dragged its anchor across the main, thus damaging the pipe. Plaintiff brought suit to recover the damages, contending that he was operating the water main properly, pursuant to federal statutes. Defendant argued that plaintiff had failed to obtain proper permission for his operations and that such activity by plaintiff was subject to the paramount right to full navigation in the bay. Affirming the trial court's ruling for plaintiff, the United States Circuit Court of Appeals, Seventh Circuit, ruled that plaintiff had secured sufficient authority from the government and that the water main was not an obstruction to navigation. (Barker-Florida)
W71-00753

IN RE WATERWAY TO UPLANDS (CONDEMNATION AWARD).
259 App Div 747, 18 NYS2d 721-723 (1940).

Descriptors: *New York, *United States, *Condemnation value, *Eminent domain, Condemnation, Compensation, Governments, Bulkhead line, Streams, Judicial decisions, Legal aspects, Property values.

In a memorandum decision wherein the facts were not stated, the Supreme Court of New York, Appellate Division, ruled that in a condemnation proceeding, the owner of the condemned property was entitled to an award representing the difference between the value of bulkhead premises before the taking and the value remaining after the taking. The court also ruled that the claimant could not recover for loss of access due to the federal government's failure to remove a damage parcel since it could be removed at any time and meanwhile was available for claimant's use without expense. (Barker-Florida)
W71-00754

JOHNSON V DRAKE (LIABILITY FOR FLOOD DAMAGE CAUSED BY BACKWATER).
142 SE 552-553 (Ga 1928).

Descriptors: *Georgia, *Dams, *Streams, *Flooding, Flood damage, Water injury, Backwater, Riparian land, Riparian waters, Riparian rights, Local governments, Cities, Highways, Public benefits, Legal aspects, Judicial decisions, Adjudication procedure, Cultivated lands.
Identifiers: *Dedications.

Plaintiff riparian owner sued to enjoin defendant riparian owner from maintaining a dam across a stream. Plaintiff also sought to recover damages to her crops resulting from flooding caused by the dam. Plaintiff contended that the dam was a continuing nuisance and that the flooding was a continuing trespass. Defendant contended that the dam was dedicated to public use, having been built originally by the city, and that the common grantor of plaintiff's and defendant's property had released defendant's predecessor from all liability in connection with the dam. The court found no error in the admission of defendant's evidence concerning the dedication and earlier release. The directed verdict for defendant was affirmed. (Liptak-Florida)
W71-00756

SOUTHERN RY V NEAL (RAILROAD'S LIABILITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).

135 SE 703-706 (Va 1926).

Descriptors: *Virginia, *Historic flood, *Obstruction to flow, *Culverts, Floods, Flood damage, Maximum probable flood, Natural flow doctrine, Railroads, Judicial decisions, Legal aspects, Damages, Streams, Streamflow, Mills, Bridges, Bridge construction, Bridge design, Backwater.

Plaintiff mill owner brought an action against defendant railroad to recover for flood damage to plaintiff's mill. The damage was caused when defendant's culvert over a stream backed up flood waters onto plaintiff's land. Plaintiff contended that defendant was negligent in constructing a culvert insufficient to pass the natural flow of the stream. Defendant contended that the damage was caused by an unprecedented flood which defendant was under no duty to anticipate when designing its culvert. The court noted that, if similar floods had previously occurred in the area, defendant should anticipate such occasional unusual flood. A lower court judgment for plaintiff was affirmed. (Liptak-Florida)
W71-00760

OPTIMALITY, 'PUBLIC' GOODS, AND LOCAL GOVERNMENTS: A GENERAL THEORETICAL ANALYSIS,
Northwestern Univ., Evanston, Ill.
For primary bibliographic entry see Field 06A.
W71-00770

CROMARTIE V STONE (LIABILITY FOR DEATH CAUSED BY IMPROPER MOORING IN NAVIGABLE RIVER).

194 NC 663, 140 SE 612-616 (1927).

Descriptors: *North Carolina, *Navigable rivers, *Boats, *Accidents, State jurisdiction, Federal jurisdiction, Dams, Rivers, Navigable waters, Locks, Channels, Admiralty, Damages, Legal aspects, Judicial decisions.

Plaintiff widow brought action against defendant barge company for the wrongful death of her husband. Plaintiff contended that defendant was negligent in mooring its boat and two barges in the calm part of a navigable river, thereby causing the husband's raft to veer into the swift part of the channel and go over a dam. Defendant contended that it was not negligent, that plaintiff's husband was contributorily negligent, and that the state court had no jurisdiction over an admiralty matter. In affirming a judgment for plaintiff, the court noted that navigable rivers were public highways which everyone had a right to use. Defendant was under a duty to use reasonable care to avoid injury to other boats and river craft. Moreover, a state may properly grant a remedy recognized by both common law and admiralty law. (Liptak-Florida)
W71-00772

PURSEL V POLSTER (LOWER RIPARIAN OWNER IS ESTOPPED FROM DENYING THE RIGHT TO DRAW WATER TO SUPPER RIPARIAN OWNER WHO HAD OBTAINED PREVIOUS PERMISSION FROM LOWER OWNER).
169 A 339-340 (NJ 1933).

Descriptors: *New Jersey, *Riparian rights, *Domestic water, *Water demand, Consumptive uses, Legal aspects, Judicial decisions, Streams, Springs, Competing uses, Relative rights, Prior appropriation, Water utilization, Diversion, Beneficial use, Potable water, Water allocation (Policy).

Plaintiff reparian owner sought to enjoin defendant landowner from continuing to draw water from plaintiff's stream and spring. While admitting that she had previously consented to defendant's use of some of the water, plaintiff contended that defendant was drawing water to such an extent that plaintiff's supply was severly diminished. Defendant contended that having acquired permission from plaintiff she was entitled to draw a reasonable amount as long as she did not interfere with plaintiff's supply. The New Jersey court held that plaintiff was estopped from denying defendant the right to take a resonable amount of water as long as plaintiff's supply was not unreasonably impaired. (Quesada-Florida)
W71-00792

NAPORRA V WECKWERTH (ACQUSITION OF PRESCRIPTIVE RIGHT TO DRAIN SURFACE WATER).
For primary bibliographic entry see Field 04A.
W71-00808

LAND AGAINST THE SEA.
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-00824

CHURCHILL V HARRIS (RIGHT TO ENTER LAND TO EXERCISE WATER RIGHTS).

257 Mass 499, 154 NE 87-88 (1926).

Descriptors: *Massachusetts, *Water rights, *Easments, *Right-of-way, Streams, Streamflow, Riparian land, Riparian waters, Riparian rights, Reasonable use, Judicial decisions, Legal aspects, Water law, Competing uses, Land tenure, Relative rights, Water supply, Real property.
Identifiers: Injunction (Restraining).

Plaintiff landowner sold land to defendant landowner, but reserved the right to use one half of a stream on the defendant's land for the use of plaintiff's adjoining property. Plaintiff sued to restrain defendant from interfering with the enjoyment of the reserved water rights. Defendant had refused to allow plaintiff onto the land to connect the pipes leading to plaintiff's land. Plaintiff contended that the reservation of the water rights necessarily implied the right to go onto the defendant's land to exercise those rights. Defendant contended that the reservation created no easement and that plaintiff should pay for such an easement. The court held that plaintiff not only had a valid appurtenant easement but also was a part owner of the land from which the spring flowed. The judgnent sustaining defendant's demmurer was reversed. (Liptak-Florida)
W71-00871

THURSTON V CARTER (BREACH OF CONTRACT TO KEEP TITLE DITCH OPEN).

155 NE 834-835 (Ind 1927).

Descriptors: *Indiana, *Tile drainage, *Obstruction to flow, *Claims (Contracts), Contracts, Ditches, Drains, Tiles, Drainage, Surface drainage, Surface water, Water rights, Legal aspects, Judicial decisions, Drainage effects, Damages, Drainage systems, Easements.

Plaintiff and defendant owned adjoining farms which were drained by a tile ditch. Plaintiff had agreed to rebuild the ditch if defendant would keep his portion of the ditch open and unobstructed. Plaintiff brought action against defendant for damages resulting from defendant's failure to keep the ditch open. Plaintiff contended that there was a valid, binding contract requiring defendant to keep the ditch open. Defendant argued that the contract simply gave plaintiff an easement across defendant's land and that it was plaintiff's duty to repair the ditch. Affirming a judgment for plaintiff, the court held that the contract was valid and that defendant, by refusing to perform, could not shift the duty of keeping the ditch open to plaintiff. (Liptak-Florida)
W71-00873

CHELTENHAM AND ABINGTON SEWERAGE CO V PUBLIC SERVICE COMM'N (DEDICATION OF SEWERAGE SYSTEM).
162 A 469-473 (Pa 1932).

Descriptors: *Pennsylvania, *Sewers, *Administrative agencies, *Rates, Clay pipes, Disposal, Drainage systems, Sewage disposal, Storm drains, Easements, Urbanization, Land tenure, State governments, Drainage, Water conveyance, Administrative decisions, Drainage programs.

Plaintiff sewerage company appealed an order of defendant public service commission abolishing plaintiff's charges for sewerage systems in two townships. The sewerage systems of the townships were installed by a promoter along with surface drainage improvements. The promoter formed plaintiff corporation, but did not convey his rights in the systems to plaintiff until after the sale of a number of lots in certain subdividions. The promoter's conveyances to the lot owners did not reserve any rights to the sewerage system. The charges for the storm sewers had been made for years. Defendant contended that these circumstances proclaimed the promoter's intent to dedicate the sewerage system to the public, and hence plaintiff did not own the system. Sustaining this contention, the court noted that the residents had a drainage easement wherever the promoter had installed drains in natural watercourses and held that plaintiff could not extract charges for the system. Plaintiff further contended that one of its employees cleaned the system after heavy rains three or four times per year, but the court held that this service did not justify compensation. Defendant's order was affirmed. (Hart-Florida)
W71-00874

EISBERGER V MAURER (DISCHARGE OF URFACE WATER ONTO ADJOINING LAND).
3 A 626-628 (NJ 1930).

escriptors: *New Jersey, *Surface waters, Drainage, *Discharge (Water), Adjudication ocedure, Judicial decisions, Legal aspects, Pipes, ainage systems, Discharge lines, Surface runoff, ddance (Legal aspects), Repulsion (Legal pects), Drainage water, Relative rights.

aintiff landowner sued defendant landowner for mages which resulted from the collection and scharge of surface water onto plaintiff's land. Defendant moved to strike the complaint. The court nied the motion, holding that defendant had no ht to collect surface water and discharge it rough a pipe onto plaintiff's land. (Hart-Florida)
71-00875

ERMONT SHADE ROLLER CO V BURLINGON TRACTION CO (MEASUREMENT OF USE F INDUSTRIAL WATER).
3 A 563-572 (Vt 1931).

escriptors: *Vermont, *Adjudication procedure, ndustrial use (Water), *Contracts, Claims (Concts), Supply contracts, Engineers, Estimates, ntract administration, Performance, Specifications, Flumes, Diversion, Structures, Sluices, Water nveyance, Water measurement, Flow measurement, Current meters.

aintiff factory owner brought action against defendant water power company to determine the ount of water plaintiff was permitted to use der an agreement entered into between defendant and plaintiff's predecessor. Plaintiff conded that the previous agreement permitted the ter used to be measured by the amount of water ich would flow through a certain opening, such ening having rounded edges. Defendant asserted t the water used should be measured by the ount of water which would flow through such ening with square edges. Finding that the timony presented was insufficient to support her contention, the court remanded the case for ther testimony to determine which opening was ntemplated by the original parties to the agreement. (Hart-Florida)
71-00878

AIRLAWN MANOR HOMES CO V WILKENS (PRESCRIPTIVE RIGHT TO MAINTAIN DAM).
2 A 470-471 (NJ 1930).

escriptors: *New Jersey, *River, *Dams, rescriptive rights, Mills, Islands, Judicial decions, Legal aspects, Dam construction, Obstruction to flow, Water supply, Relative rights, Alteration of flow.

aintiff island landowner sought a declaratory dgment determing the right of defendant dam ner to maintain a dam on the river in which aintiff's island was located. Plaintiff contended t the dam was an illegal obstruction which used the river to flow on only one side of his and. Defendant claimed a prescriptive right to aintain the dam. The court found that the dence demonstrated that defendant and his decessors had maintained the dam at the same ght for more than the prescriptive period of 20 ars. The court held that defendant had acquired prescriptive right to maintain the dam and missed plaintiff's petition. (Hart-Florida)
71-00891

ORK V GOLDER (EXISTENCE OF A RAINAGE EASEMENT OF NECESSITY).
1 A 558-559 (Me 1930).

escriptors: *Maine, *easements, *Adjudication ocedure, *Ditches, Culverts, Drainage, Drainage stems, Drainage practices, Judicial decisions, gal aspects, Relative rights.

Plaintiff landowner sued defendant landowner for damages which resulted from the obstruction of a drainage ditch on defendant's land. Plaintiff claimed an easement of necessity for drainage across defendant's lot. Defendant contended that since the ditch did not exist at the time of the trial, or exist at the time of his purchase, plaintiff had no easement. The court noted three requirements for plaintiff to have an easement of necessity: (1) there was an open drain; (2) its purpose was obvious; and (3) it was necessary for the reasonable enjoyment of plaintiff's lot. The court, reviewing the evidence, held that the jury below could properly have found that no ditch existed, and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-00914

WATER POLLUTION CONTROL LEGISLATION,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W71-00935

GODDARD V BERLIN MILLS CO (LIABILITY FOR FLOODING CAUSED BY BACKWATER FROM DAM).

131 A 601-606 (NH 1926).

Descriptors: *New Hampshire, *Dams, *Backwater, *Flood damage, Water injury, Rivers, Navigable rivers, Riparian land, Damages, Obstruction to flow, Milldams, Water levels, Lumbering, Legal aspects, Judicial decisions, Water rights, Prescriptive rights, Adjudication procedure.

Plaintiff landowner brought action against defendant mill and dam owner to recover damages caused by backwater from the dam and from logs defendant floated and stored on the river. Plaintiff contended that closing all of defendant's flashboards had raised the water level of the river and overflowed plaintiff's land five miles upriver. Plaintiff also alleged that defendant negligently ran logs on the river, thereby damaging defendant's bank. Defendant denied the overflow, asserted a prescriptive right to maintain its dam at its present height and claimed the right to drive logs on the river. The court noted that plaintiff commenced his action before the prescriptive 20-year period had expired and that the right to drive logs on the river was conditioned on the exercise of ordinary and reasonable care. The court found that the evidence, although inconclusive, was sufficient to justify the jury's verdict and the resulting judgment for plaintiff. (Liptak-Florida)
W71-00938

ALEXANDER V WABASH RY (LIABILITY FOR OBSTRUCTION OF SURFACE RUNOFF).
38 SW2d 545-550 (Mo 1931).

Descriptors: *Missouri, *Embankments, *Surface runoff, *Obstruction to flow, Damages, Judicial decisions, Legal aspects, Crops, Railroads, Beds, Drainage, Watercourses (Legal), Ditches, Discharge (Water), Laterals, Drains, Impoundments, Conduits, Flumes, Natural flow, Alteration of flow, Impounded waters, Water injury, Flood damage, Overlying proprietors, Surface waters.

Plaintiff brought suit against defendant railroad for damages to their crops. Defendant built an embankment upon their right-of-way. Plaintiff alleged that the embankment was negligently constructed and maintained in that it provided inadequate drainage for surface waters and excessive precipitation, thereby causing an increased flow of water over plaintiff's lands. Defendant contended that their drainage facilities were adequate and that plaintiff, as lower proprietor, was occupant of the servient estate over which excess waters could flow in their natural course. The court affirmed the trial court's dismissal of the action against defendant since there was no evidence of a material fact upon which relief could have been granted. (Barnett-Florida)
W71-00965

CHICAGO, ST LOUIS AND NEW ORLEANS RR V ADKINS (LIABILITY FOR OBSTRUCTION TO FLOW DUE TO INSUFFICIENT PASSAGE IN RAILROAD EMBANKMENT).
247 Ky 241, 56 SW2d 969-972 (1933).

Descriptors: *Kentucky, *Obstruction to flow, *Flooding, *Surface drainage, Excessive precipitation, Rain, Rainfall, Drainage, Ditches, Drainage systems, Drainage water, Flow, Barriers, Damages, Flood damage, Floods, Overflow, Backwater, Flood water, Judicial decisions, Railroads, Embankments, Legal aspects.

In an action for damages, plaintiffs contended that defendant railroad company caused water to be diverted upon their lands. Plaintiffs contended that defendant negligently constructed an embankment over a drainage system ditch in that the embankment left insufficient passageways for water to flow in the ditch. Plaintiffs contended that such obstruction resulted in waters being backed up and caused to overflow, resulting in plaintiffs' lands being flooded. Defendant contended that the flooding was caused by excessive rains and that the overflow of the ditch would have occurred notwithstanding the railroad embankment. The court ruled that the issue of whether or not the embankment caused the flooding was a question for the jury. The court held that there was sufficient evidence to uphold the jury's determination that the embankment left insufficient passage for the waters and was a proximate cause of the flooding. The court also approved the trial court's instruction that the amount of damages was measured by the diminution in market value caused by the overflow. (Snow-Florida)
W71-00966

CHESAPEAKE AND O RY V STEPHENS (FLOODING CAUSED BY OBSTRUCTION OF CULVERT UNDER RAILROAD).
236 Ky 232, 32 SW2d 993-994 (1930).

Descriptors: *Kentucky, *Flood damage, *Adjudication procedure, *Compensation, Flooding, Streams, Water injury, Railroads, Obstruction to flow, Judicial decisions, Legal aspects, Real property, Property values.

Plaintiff landowner sued defendant railroad company for damages which resulted from the flooding of his property. Plaintiff contended that defendant had diverted a stream onto his land, thereby causing the flood injury. Defendant asserted that the injury was caused by a prior extraordinary flood. The court held that the decision of which act caused the injury was for the jury. The court went on to hold that $500 damages for injury to 1/2 acre of land awarded by the jury was excessive, and remanded the case for a new trial. (Hart-Florida)
W71-00967

FUNKE V ST LOUIS - SAN FRANCISCO RY (LIABILITY FOR DISCHARGE OF SURFACE WATER COLLECTED IN DITCH.
35 SW2d 977-982 (Mo 1931).

Descriptors: *Missouri, *Flood damage, *Surface drainage, *Adjudication procedure, Surface runoff, Drainage water, Overland flow, Repulsion (Legal aspects), Riddance (Legal aspects), Railroads, Legal aspects, Judicial decisions, Ditches.

Plaintiff landowner sued defendant railroad company for damages which resulted from the diversion of surface water onto plaintiff's land. Plaintiff contended that defendant had collected the water in a ditch and discharged it onto his land. Defendant contended that the lower court erred in failing to sustain his demurrer at the close of plaintiff's evidence. The court noted that any landowner could rid his property of surface water so long as it was not collected and discharged to his neighbor's injury. The court held that the lower court had properly determined that the question of whether defendant had collected the water was for the jury. The lower court's judgment for plaintiff was affirmed. (Hart-Florida)
W71-00969

CHESAPEAKE AND O RY V CLIFTON (LIABILITY FOR FLOODING CAUSED BY OBSTRUCTION OF CULVERT UNDER RAILROAD).
237 Ky, 519, 35 SW2d 884-886 (1931).

Descriptors: *Kentucky, *Flooding, *Wells, *Damages, Shallow wells, Seepage, Underseepage, Water pollution, Water pollution effects, Water pollution sources, Streams, Rivers, Streambeds, Obstruction to flow, Overflow, Flood damage, Compensation, Culverts, Judicial decisions, Legal aspects, Adjudication procedure, Railroads.

Plaintiff riparian landowner sued defendant railroad for damages which resulted from the flooding of his property. Defendant owned a right-of-way adjacent to plaintiff's land. Defendant built its railroad over a stream, placing a culvert in the streambed. The culvert clogged with debris, backing up the stream onto plaintiff's land. Plaintiff asserted the flooding injured his property and polluted his well. The court determined that the lower court had erred in allowing damages in the diminution in property value, and stated that the proper measure of damages was the diminution in rental value, since the injury was temporary. The damages for injury to the land were held to be excessive. Furthermore, since a river had recently flooded plaintiff's well, and the culvert overflow had not flooded the well but could only have caused the pollution by seepage, the evidence was held insufficient to establish that the culvert overflow was the proximate cause of plaintiff's well pollution. The case was reversed and remanded for a new trial. (Hart-Florida)
W71-00970

CAVITT V FOWLER (OWNER MAY CONSTRUCT DAM AND DITCH ON OWN LAND TO RECLAIM LAND).
285 SW 175-178 (Mo 1926).

Descriptors: *Missouri, *Land reclamation, *Land development, *Wetlands, Swamps, Drainage, Drainage practices, Land management, Dams, Dam construction, Earth dams, Diversion structures, Flow control, Flood control, Levees, Ditches, Rivers, River flow, Ponds, Channels, Conveyance structures, Water rights, Riparian rights, Water conveyance, Judicial decisions, Legal aspects.

Due to a drainage district's dredging and straightening of a river channel upstream from plaintiff's and defendant's lands, the flow of such river through defendant's land was increased. In order to protect his lowlands from overflow, defendant constructed a dam and ditch to straighten the river channel on his land. Defendant conveyed the water from the dam into a pond which emptied into the river on the downstream section of his land. Plaintiff, who owned adjoining land downstream from defendant, brought an action to recover damages which resulted to his land and crops. Plaintiff alleged that defendant wrongfully constructed and maintained the dam and ditch which caused the river flow to flood plaintiff's land. The St. Louis Court of Appeals affirmed the lower court's judgment for defendant. The court held that defendant, as owner of land made swampy by the straightened condition of the river, had the right to construct the dam or ditch and empty excess water into the river which ran through this property for purposes of reclaiming and improving his land. (Powell-Florida)
W71-00971

TIDE WATER OIL SALES CORP V SHIMELMAN (LIABILITY FOR INTERFERENCE WITH DRAINAGE OF SURFACE WATER).
158 A 229-231 (Conn 1932).

Descriptors: *Connecticut, *Surface drainage, *Surface runoff, *Obstruction to flow, Overland flow, Surface waters, Drains, Water spreading, Legal aspects, Judicial decisions, Watersheds (Divides), Natural flow, Water rights, Alteration of flow, Reasonable use, Relative rights, Watercourses (Legal).

Plaintiff and defendant owned adjoining tracts of land. Plaintiff's land was drained of surface water by means of a natural depression which ran across defendant's property. During construction of improvements upon his premises, defendant filled in the depression. This resulted in an accumulation of water on plaintiff's land which previously would have flowed through the depression. Plaintiff brought an action for damages and an injunction, alleging the right as an owner of lands from which surface water flows to relief against an obstruction of that flow. The Superior Court of Errors of Connecticut, in affirming the lower court decision held that where the drainway was not well defined, plaintiff was not entitled to prevent defendant's interference with the drainage of surface water over his land. The court reasoned that a land-owner cannot prevent interference with drainage of surface water over adjacent land unless a servitude is impressed upon the property. The court held, however, that plaintiff was entitled to enjoin defendant from discharging surface water in increased volume onto plaintiff's land. (Powell-Florida)
W71-00973

MISSOURI PAC RR V NICHOLS (RAILROAD FAILING TO PROVIDE OPENINGS IN EMBANKMENTS LIABLE FOR FLOODING LANDS).
279 SW 354-357 (Ark 1926).

Descriptors: *Arkansas, *Embankments, *Railroads, *Floods, Judicial decisions, Legal aspects, Engineering structures, Road banks, Riparian rights, Riparian land, Riparian water, Watercourses (Legal), Streams, Overflow, Overland flow, Rain water, Rain, Surface waters, Surface runoff, Excessive precipitation.

The roadbed of defendant railroad crossed a creek adjacent to plaintiff's land. The creek had been straightened and was used as a drainage ditch. A 120-foot opening in the railroad embankment through which creek waters flowed was reduced by defendant to a 4-foot concrete box. During a rainfall water backed up onto plaintiff's land, thereby destroying his crops. Plaintiff brought an action for damages, alleging that the lack of a sufficient opening in defendant's roadbed caused such damages. Defendant presented evidence indicating the sufficiency of the opening. The Supreme Court of Arkansas affirmed the trial court's judgment for plaintiff, holding that the evidence presented supported plaintiff's verdict. The court stated that if defendant failed to provide openings so as not to flood plaintiff's land either at ordinary water stage or during floods which could reasonably have been foreseen, it was liable. The court determined that defendant's duty to provide a water outlet was continuous. Also, defendant should have provided an outlet, not merely for water falling within the banks of the stream crossed, but for all water which customarily flowed into the stream from the surface of the adjacent land. (Powell-Florida)
W71-00974

LUTESVILLE SAND AND GRAVEL CO V MCLAUGHLIN (OWNERSHIP OF SANDBAR IN NAVIGABLE STREAM).
26 SW2d 892-895 (Ark 1930).

Descriptors: *Arkansas, *Navigable waters, *Ownership of beds, *Sand bars, Gravels, Damages, Remedies, Judicial decisions, Legal aspects, Tidal waters, Riparian rights, Riparian land, High water mark, Beds under water, Public rights, Permits, Federal government, Bridges, Meanders, Navigable rivers, Boundary disputes, Land tenure, Accretion (Legal aspects).

Plaintiff brought suit against defendant gravel company to recover the value of gravel allegedly taken from her land. The gravel was removed from a sand bar, opposite plaintiff's land, which plaintiff alleged was an accretion to her land. Defendant alleged that the bar was not an accretion to plaintiff's land but, being situate in the bed of a navigable river, was public domain. The central issue for determination was whether or not the stream was navigable. The Supreme Court of Arkansas stated that a riparian owner on a non-navigable stream takes title to the center of the stream ratably with other riparian owners, his extent of interest being dependent on the frontage of his land upon the stream. However, a riparian owner on a navigable stream takes only to the high water mark. Evidence adduced at trial was sufficient to show the stream was navigable and as such, precluded plaintiff's recovery. (Barnett-Florida)
W71-00976

COZY LAKE, INC V NYODA GIRL'S CAMP INC (RIPARIAN RIGHT TO NATURAL FLOW OF A STREAM).
128 A 149-150 (NJ 1925).

Descriptors: *New Jersey, *Dams, *Natural flow, *Riparian rights, Spillways, Streams, Channels, Streamflow, Flow, Regulated flow, Alteration of flow, Obstruction to flow, Judicial decisions, Natural flow doctrine, Riparian land, Riparian waters, Reasonable use.

In an action for an injunction, plaintiff, a lower riparian owner, contended that it was being deprived of the natural flow of water from a stream. Plaintiff contended that defendant, an upper riparian owner, had constructed a dam with insufficient spillways which resulted in the retardation of the flow of the stream. Defendant contended that the dam did not materially alter the flow of the stream. The court held that an upper riparian owner may use the water of a stream in a reasonable manner so long as he does not destroy, render useless or diminish the flow of the stream to a lower riparian. The court ruled that there was no evidence to support the claim that any water had been materially diverted from its usual channel or that the flow of the stream had been diminished by the dam. Consequently, plaintiff's bill for an injunction was dismissed. (Snow-Florida)
W71-00977

HENDRIX V MCEACHERN (LIABILITY FOR OBSTRUCTION OF NATURAL DRAINAGE OF UPPER LAND).
139 SE 9-11 (Ga 1927).

Descriptors: *Georgia, *Surface drainage, *Diversion, *Obstruction to flow, Discharge (Water), Natural flow, Surface water, Surface runoff, Drainage, Dams, Boundary disputes, Watercourses (Legal), Land, Land tenure, Damages, Legal aspects, Judicial decisions, Backwater, Reasonable use, Relative rights.

Plaintiff upper landowner brought action against defendant lower landowner to recover a strip of land allegedly taken by defendant and to recover damages which resulted from the construction of the strip of a wall which interfered with the natural drainage of plaintiff's land. Defendant contended that plaintiff had erected a garage on her land which interfered with the natural flow of water and caused it to be discharged at a different place on defendant's land and in a greater quantity than would normally occur. The trial court found for defedant, and the Supreme Court of Georgia affirmed. It is a settled rule that a lower landowner owes a servitude to an upper landowner to receive the water which naturally runs from it, provided the upper owner has not acted to increase the flow of such water by artificial means. The court found that plaintiff had so altered the natural flow of water, and under such circumstances defendant could protect the drainage of his own land. (D... Florida)
W71-00980

STEN V TEXAS CO (POLLUTION OF SUB-RFACE WATERS).
NC 540, 140 SE 89-90 (1927).

criptors: *North Carolina, *Water pollution, bsurface waters, *Wells, Underground streams, tercourses (Legal), Soil contamination, Soil tamination effects, Water pollution effects, er pollution sources, Gasoline, Flow, Natural , Legal aspects, Judicial decisions, Water quali-

ntiff's brought suite against defendant corpora- for contamination of a well with gasoline from nk on defendant's land. Evidence showed that ntiffs' well water had been pure before installa- of the gas tank. After installation, there was tamination, and an inspection of the tank wed a leak. From the trial court's granting of a suit, plaintiffs appealed. An intermediate appel- court reversed and remanded the case for trial he facts. Defendant appealed, and the Supreme rt of North Carolina affirmed. The evidence sufficient to submit the issue of contamination he jury. The court stated that one who, by per- ting pollution of his own soil or water reunder, contaminates his neighbor's wells or ams under his neighbor's land is liable in ages, and in some instances such pollution will estrained by injunction. (Duss-Florida)
1-00981

GINIA HOT SPRINGS CO V HOOVER (LIA-ITY FOR DIVERSION OF SPRING TERS).
SE 408-411 (Va 1925).

criptors: *Virginia, *Diversion, *Streams, easonable use, Springs, Judicial decisions, Legal ects, Alteration of flow, Diversion structures, ural flow doctrine, Riparian rights, Pipelines, ter supply, Riparian land, Riparian waters, ative rights, Remedies, Intermittent streams, ing waters.

intiff landowners sued to restrain defendant ort hotel company from diverting the natural w of a stream and thereby cutting off plaintiffs' water supply. Defendant had contracted with upper riparian owner for the right to divert the ng waters feeding the stream, but plaintiffs con-ded that defendant was only entitled to divert as ch water as the upland owner, a small farmer, uld have used -- not the amount required for de-dant's resort operation. Defendant contended t the normal streamflow did not reach plaintiffs' d during the dry season, which was the only time endant diverted any water. Finding that the dence supported plaintiffs' claim, the court af-ned a judgment for plaintiffs. (Liptak-Florida)
1-00982

L BALSO HOLDING CORP V MCKENZIE WNERSHIP OF UPLAND AND RIPARIAN GHTS).
Misc 498, NYS2d 790-796 (1937).

scriptors: *New York, *Riparian rights, *Ad-nistrative agencies, *High water mark, Low ter mark, Judicial decisions, Legal aspects, deral government, Riparian waters, Shores, ds, Streams, Navigable waters, Construction, rs, Cities, Boundaries, Tides, Channels, eather patterns, Windtides, Winds, Topography, ps, Land tenure, Real property.

itioner corporation sought an order of man-mus compelling the New York dock commis-ner to permit petitioner to construct a pier on a ek. Petitioner alleged ownership of upland be-d the point where the pier was to be erected, reby giving petitioner riparian rights and the vilege of constructing a pier. The city opposed itioner's claim by alleging the existence of a high ter mark of the creek inshore of the boundaries the upland claimed by petitioner. If such were e case, petitioner would have no rights in the land in question since the city was vested with ownership of land between the high and low water marks. Petitioner relied upon the dock department's prior use of a high water mark for many years which gave petitioner title to some upland. The city sought to establish a new high water mark, utilizing various findings of the federal government. The court found these new findings inconsistent in themselves and a departure from the city's own prior practices. The court held that petitioner had shown unequivocal title to the land in question, and under the accepted high water mark, was definitely the owner of some upland. Consequently, petitioner had the right to construct a pier. (Duss-Florida)
W71-00983

PLACE V UNION TOWNSHIP (MUNICIPAL LIABILITY FOR ALTERATION OF NATURAL DRAINAGE).
66 SW2d 584-591 (Mo 1934).

Descriptors: *Missouri, *Drainage, *Obstruction to flow, *Dams, Repulsion (Legal aspects), Overflow, Roads, Rivers, Levees, Floods, Legal aspects, Diversion, Alteration of flow, Surface waters, Natural streams, Watercourses (Legal), Surface runoff, Flood damage, Relative rights, Remedies, Flood plains, Natural flow, Drainage practices, Ditches.

Plaintiffs sought to force defendant township to rebuild several dams across a road ditch. It was alleged that the road and ditch cut across several ridges which had acted as natural levees protecting plaintiffs' property from floodwaters from a nearby river and from surface runoff. Defendant urged that any overflow resulted from surface waters, which under the 'common enemy rule' each landowner must repel as best he can, and therefore that removal of the dams had resulted in no legal injury to plaintiffs. The court rejected this contention, finding that the sloughs between the ridges were natural waterways. This being so, any diversion of the natural flow of such waterways gave rise to an actionable wrong to those injured thereby. The court found that construction of the road and ditch diverted floodwaters from their natural paths in the sloughs onto plaintiffs' property, and affirmed the trial court's judgment requiring defendant to rebuild the dams in question to prevent flood damage to plaintiffs. (Caldwell-Florida)
W71-00985

MOBILE AND O RR V TAYS (LIABILITY FOR ALTERATION OF SURFACE WATER FLOW BY CONSTRUCTION OF RAILROAD EMBANKMENT).
107 So 871-874 (Miss 1926).

Descriptors: *Mississippi, *Railroads, *Alteration of flow, *Flood damage, Bridges, Obstruction to flow, Natural streams, Diversion, Overflow, Structures, Legal aspects, Embankments, Natural flow, Streams, Surface waters, Surface runoff, Repulsion (Legal aspects), Relative rights, Judicial decisions, Construction, Culverts, Floods.

Defendant railroad had started to replace a trestle with an embankment. Plaintiff sought to enjoin this action, claiming that the embankment would divert surface runoff onto his property, thereby causing flood damage. The court denied the injunction, stating that plaintiff had failed to allege that the trestle was cheaper, safer and more convenient than the embankment. The court held that the duty imposed by law on railroads to provide suitable and safe roadways carried with it the right to construct embankments to support those roadways when necessary. When this right was exercised with due regard to the rights of adjacent landowners, any necessary injury resulting from the embankment must be borne by the owner. Plaintiff, by failing to allege that the trestle was cheaper, safer and more convenient, had failed to show sufficient injury to his property to allow an injunction to issue. (Caldwell-Florida)
W71-00986

TILDEN V SMITH (RIPARIAN OWNER MAY LOWER LAKE TO ORDINARY HIGH WATER MARK).
113 So 708-712 (Fla 1927).

Descriptors: *Florida, *High water mark, *Drainage wells, *Floodwater, Legal aspects, Judicial decisions, Remedies, Lakes, Water levels, Riparian rights, Riparian land, Riparian water, Floods, State governments, Legislation, Rainfalls, Weather, Banks, Vegetation, Water level fluctuations, Agriculture, Golf courses.

Plaintiffs sought to enjoin defendant from lowering the level of Lake Johns by drilling a deep well to let water drain underground. Defendant contented that the water level in the lake was excessively high because of abnormal rainfall and that his golf course, as well as property of other riparian owners, was flooded. Plaintiffs insisted that, if the level were lowered, they would receive less frost protection for their crops in dry years. The Supreme Court of Florida affirmed a lower court opinion denying the injunction. The court held that the state statute allowing an injuction against lowering of lake levels applied only to the ordinary high water mark, not the highest level the water reached. The court found sufficient evidence from vegetation and trees to establish that the ordinary high water mark was lower than the level at the time of plaintiff's suite. (Morris-Florida)
W71-00987

MAGINNIS LAND AND IMPROVEMENT CO V MARCELLO (OWNERSHIP OF BATTURE LANDS).
168 La 997, 123 So 653-655 (1929).

Descriptors: *Louisiana, *Accretion (Legal aspects), *Boundary disputes, *Bayous, Beds, Boundaries (Property), Prescriptive rights, Land tenure, Real property, Riparian land, Riparian waters, Riparian rights, Dry beds, Legal aspects, Judicial decisions, Maps, High water mark.

Plaintiff landowner sued ten defendant landowners to quiet title to batture property which was in defendants' possession. Plaintiff had sold lots to defendants but contended that the batture property was not included in the sale according to the recorded map of the property. Defendants contended that their deeds conveyed the land up to the water and that the batture property was theirs by right of accretion. Affirming a judgment for plaintiff, the court held that defendants' property boundaries were controlled by the recorded map where the deeds were in conflict with the map, and that the only evidence showed that the batture existed before plaintiff sold the lots to defendants. Therefore, the batture land was plaintiff's by right of accretion and was not included in the sale of the lots to defendants. (Liptak-Florida)
W71-00988

SMITH V MCELDERRY (RIPARIAN OWNER'S LIABILITY FOR DIVERSION AND ALTERATION OF NATURAL FLOW OF STREAM).
124 So 896-97 (Ala 1929).

Descriptors: *Alabama, *Diversion, *Natural flow doctrine, *Riparian rights, Obstruction to flow, Alteration of flow, Reasonable use, Streamflow, Riparian land, Riparian waters, Ditches, Legal aspects, Judicial decisions, Prescriptive rights, Remedies, Relative rights, Streams, Diversion structures.

Plaintiff riparian owners sued to restrain defendant riparian owner from diverting water from the stream separating their property. Plaintiffs contended that they were entitled to the natural flow of the stream and that defendant, by diverting water into a ditch which later emptied back into the stream, had reduced the stream flow so that the channel had become clogged with logs and debris and was therefore useless. Defendant argued that he had a prescriptive right to maintain the ditch, since it had been dug 25 to 40 years before he had

acquired the property, and also contended that he was under a duty only to maintain the streamflow as it existed when he purchased the property. Affirming a judgment for defendant, the court held that defendant had acquired a prescriptive right, particularly since plaintiffs had dug a similar ditch on their own property, and that defendant now had no right to materially alter the flow of the stream. (Liptak-Florida)
W71-00989

GREENFIELD V POWELL (TITLE DISPUTE TO LAND FORMED BY AVULSION).
127 So 171-173 (Ala 1930).

Descriptors: *Boundary disputes, *Avulsion, *Accretion (Legal aspects), *Alabama, Bank erosion, Stream erosion, Channels, Streams, Boundaries (Property), Legal aspects, Judicial decisions, Prescriptive rights, Remedies, Erosion, Riparian land, Riparian rights, Riparian waters, Real property, Land tenure, Sands, Gravels.

Plaintiff riparian owner brought action in ejectment against defendant riparian owner and also sought to recover damages for conversion of sand and gravel that defendant claimed by accretion. Plaintiff contended that the stream separating the lands in question had suddenly changed course because of a freshet which eroded plaintiff's banks and enlarged defendant's bank, that this action was due to avulsion, and, therefore, that defendant had no right to the newly formed land. Defendant contended that the land was formed by accretion, was therefore his, and that the sand and gravel deposited on his bank was not the same as that washed away from plaintiff's bank. Affirming a judgment for plaintiff, the court held that the evidence clearly showed a sudden and distinct change in the stream's channel. Such could only result from avulsion, and the new land formed on one side of the stream need not be the same that washed away from the other side. (Liptak-Florida)
W71-00990

WINEMAN V WITHERS (BOUNDARY DISPUTE OVER LAND FORMED IN NON-NAVIGABLE RIVER BY ACCRETION).
108 So 708-709 (Miss 1926).

Descriptors: *Mississippi, *Accretion (Legal aspects), *Boundary disputes, *Ownership of beds, Rivers, Non-navigable waters, Streams, Stream erosion, Boundaries (Property), Channel erosion, Bank erosion, Riparian Land, Riparian waters, Legal aspects, Judicial decisions, River beds, Real property, Running waters, Remedies, Erosion, Beds under water.

Plaintiff riparian owner sued defendant riparian owner to quiet title to land formed by accretion in front of their adjoining property. Prior to this accretion, the river bed had encroached on both parties' lands. Plaintiff contended that the boundary line should be drawn at a right angle to the thread of the stream from a point where the original property line intersected the river bed where it had encroached onto the property before the process of accretion began. Defendant contended that the line should be drawn at a right angle to the thread of the stream from a point where the boundary intersected the river bed at its original location before the encroachment and recession of the river. Affirming a judgment for defendant, the court held that upland owners on non-navigable rivers own the bed of such rivers to the middle of the stream, and therefore the encroachment and recession of the river in the instant case did not change the original boundary of the property which already belonged to the upland owners. The court also held that the boundary of the accreted land was properly drawn from the property line at the river bed's original location. (Liptak-Florida)
W71-00991

JAMES V HAMM (LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF DITCHES).
1 SW2d 552-553 (Ark 1928).

Descriptors: *Arkansas, *Drainage practices, *Ditches, *Flood damage, Relative rights, Drainage, Streams, Overflow, Surveys, Floods, Levees, Damages, Alteration of flow, Obstruction to flow, Legal aspects, Surface runoff, Judicial decisions, Surface waters.

Defendant constructed a drainage ditch across his property. Plaintiff brought action for damages, claiming that the dirt from the excavation of this ditch formed a levee which caused water to overflow onto plaintiff's adjacent property. Defendant contended that plaintiff had wrongfully constructed several drainage ditches which resulted in channelling an increased amount of surface runoff toward defendant's ditch. Defendant alleged that, but for plaintiff's ditches, his ditch would have been adequate to take care of all the water flowing toward it from plaintiff's property. The court held that it was plaintiff's ditches rather than the levee which resulted in the damage. A lower court decision for defendant was affirmed. (Caldwell-Florida)
W71-00992

SMITH V CITY OF KUTTAWA (TITLE TO LAKE AND PARK).
222 Ky 569, 1 SW2d 979-985 (1928).

Descriptors: *Kentucky, *Lakes, *Cities, *Land tenure, Relative rights, Public benefits, Real property, Parks, Land use, Recreation, Easements, Legal aspects, Water rights, Maps, Judicial decisions.

Plaintiff sought to assert his title to a large tract of land as against defendant city. The land in question included a lake and areas that were being used as parks. Defendant argued that plaintiff's predecessor in title had granted an easement to the city and its citizens to use the lake for recreational and other purposes. Defendant further claimed that it had the fee simple title to the lake and park, basing its claim on an adverse possession and dedication. The court held that even though defendant's easement was never recorded, the use of the lake was so open and notorious that plaintiff took the land with notice of defendant's rights. The court also held, however, that defendant's rights had not ripened into a fee simple title, but that it merely retained an easement. Plaintiff was therefore declared to own the property in fee simple, subject to defendant's easement. (Caldwell-Florida)
W71-00993

WHITE CONST CO V BROOKS (LIABILITY FOR OBSTRUCTION OF STREAM ALLEGED TO HAVE CAUSED FLOOD DAMAGE).
222 Ky 621, 1 SW2d 1076-1079 (1928).

Descriptors: *Kentucky, *Obstruction to flow, *Flood damage, *Damages, Alteration of flow, Construction, Barriers, Diversion, Streams, Relative rights, Streamflow, Legal aspects, Adjudication procedure, Floods, Real property, Overflow, Excessive precipitation, Bridges, Judicial decisions.

Plaintiff landowner brought action against defendant corporation for damages, alleging that defendant had wrongfully torn down a bridge over a stream and filled in the stream with rock, thus causing plaintiff's land to be flooded. The court held that the testimony of a witness for defendant that the cause of plaintiff's flood damage was an extraordinary rainfall rather than the obstruction of the stream was wrongfully excluded. The court also held that in view of all the surrounding circumstances, including the fact that plaintiff had not requested removal of the obstruction until after the flood, an award of punitive damages was erroneous. The lower court's decision for plaintiff was reversed. (Caldwell-Florida)
W71-00994

FRAZIER V LOUISVILLE AND N RR (LIABILITY FOR FLOOD DAMAGES FROM EXTRAORDINARY RAINFALL).
231 Ky 107, 21 Sw2d 140-142 (1929).

Descriptors: *Kentucky, *Culverts, *Railroads, *Flood damage, Obstruction to flow, Surface runoff, Structures, Embankments, Excessive precipitation, Maximum probable flood, Surface waters, Drainage, Damages, Floods, Legal aspects, Relative rights, Overflow, Judicial decisions.

Plaintiff landowner brought action against defendant railroad to recover damages for injuries to this property. A flood in May 1927 left a culvert under a railroad embankment near plaintiff's house clogged with debris. Plaintiff claimed that defendant had negligently failed to clean out this debris which resulted in floodwaters backing up and damaging his house during a subsequent flood in July. The court held that defendant was only under an ordinary duty of care to avoid flood damage to plaintiff. The July flood was found to have been extraordinary and beyond anything that might reasonably have been anticipated. The court found that defendant had in fact cleaned out the culvert sufficiently to take care of any runoff that might ordinarily have been expected. The court held, therefore, that the unforseeable floods and not defendant's negligence had been responsible for the damage to plaintiff's house. The fact that plaintiff himself had done nothing to clear the culvert also weighed against him. (Caldwell-Florida)
W71-00995

CHESAPEAKE AND O RY V WEDDINGTON (LIABILITY FOR DAMAGES RESULTING FROM OVERFLOW OF CREEK).
231 Ky 745, 22 SW2d 131-133 (1929).

Descriptors: *Kentucky, *Railroads, *Landslides *Overflow, Alteration of flow, Diversion, Obstruction to flow, Legal aspects, Right-of-way, Damages Erosion, Relative rights, Streams, Flood damage Real property, Channel flow, Judicial decisions Floods.

Plaintiff landowner brought action against defendant railroad for damages which resulted to his land when an unusually large quantity of dirt and stones which defendant had piled upon its right-of-way slid of its own weight into an adjacent creek forcing the creek waters to flow over plaintiff's property. Defendant contended that it had merely made use of its own land without negligence, and damage to adjacent landowners from such use being non-compensable. The court held that the unusual size of the pile, and the fact that it had slipped of its own weight into the creek, made the resulting injury a wrongful one. Since the injury was not of a class of incidental damages, unavoidable in the course of railroad operation, plaintiff could recover. The amount of the verdict for plaintiff was held to be excessive, however, and the case was remanded for a proper determination of damages. (Caldwell-Florida)
W71-00996

KENWELL V LEE (STATE PROPERTY NOT TO BE USED IN NON-MUNICIPAL WATER DISTRICT).
267 NY 481, 196 NE 406-408 (1935).

Descriptors: *New York, *Cities, *Water district *Project planning, Water policy, State governments, Local governments, Judicial decision Legal aspects, Lakes, Reservoirs, Land, Wat supply, Municipal water, Legislation.

In a per curiam decision wherein the facts were n disclosed, the Court of Appeals of New York rul that a state-owned lake and lands incidental to could not be used as a reservoir in a proposed m nicipal water district. The proposal for t establishment of the water district was therefo null and void. (Barker-Florida)
W71-00997

ACLEOD V DAVIS (PRESCRIPTIVE RIGHT O USE SEWER DRAIN).
0 Mass 335, 195 NE 315-217 (1935).

escriptors: *Massachusetts, *Drains, *Prescrip-e rights, *Sewers, Pipes, Easements, Adjudica-n procedure, Conduits, Drainage systems, Cities, ainage practices, Drainage, Judicial decisions, gal aspects, Relative rights.

aintiff landowner brought suit in equity to com-l defendant to reopen a sewer drain which ran rough defendant's property. Plaintiff's predeces-r had installed the drain under agreement with fendant's predecessor, and the drain had been in e for over 30 years before defendant closed it. e Supreme Judicial Court of Massachusetts held at, based on all the evidence, plaintiff's right to e the drain had become a prescriptive right. De-ndant could not interfere with such a right. arker-Florida)
71-00998

EINE V BANDELIER (DAMAGE FROM IM-ROPER DRAINAGE PRACTICE).
0 NE 617-618 (Ind 1934).

escriptors: *Indiana, *Drainage practices, rainage effects, *Riddance (Legal aspects), ainage water, Damages, Drains, Tiles, Laterals, nduits, Ditches, Discharge (Water), Runoff, Ju-cial decisions, Legal aspects, Adjudication ocedure.

aintiff landowner brought suit against defendant ighboring landowner for damages allegedly used when defendant collected and discharged ge amounts of water onto plaintiff property. aintiff contended that the damages arose when fendant refused to connect lateral drains and en defendant constructed sewer drains which ptied onto plaintiff's land. Defendant argued at plaintiff was required to negative a claim of ntributory negligence. The Appellate Court of diana ruled that in a case not based on negligent ury, the plaintiff need not present evidence to gative contributory negligence. The trial court's cision awarding damages to plaintiff was af-med. (Barker-Florida)
71-00999

ENWELL V LEE (STATE PROPERTY NOT TO E USED IN NON-MUNICIPAL WATER DIS-RICT).
1 NY 113, 184 NE 692-694 (1933).

escriptors: *New York, *Cities, *Water districts, Water supply, Project planning, Water policy, ate governments, Local governments, Lakes servoirs, Municipal water, Legislation, Adminis-tive decisions, Judicial decisions, Legal aspects.

aintiff taxpayer brought suit against defendant wn supervisor to prevent issuance of bonds to ance the establishment of a water district. The wn had adopted a plan whereby a lake which was thin a state-owned forest preserve would be used a water supply for the water district. The boun-ries of the town and the water district were entical. Permission for the establishment of the strict had been granted by the State of New York, d plaintiff's challenge to the plan was dismissed the trial and appellate courts. The Court of Ap-als of New York reversed the lower decisions, lding that the state laws and constitution allowed r use of state-owned water only as a water supply r municipalities. A water district, as created in is case, did not come within the definition of 'mu-cipalities' contemplated by such laws. Judgment r plaintiff was granted and the plan held invalid. arker-Florida)
71-01000

HITLING V TYLER (EQUITABLE RELIEF ROM OBSTRUCTION TO FLOW).
21 Ohio St 125, 167 NE 365-366 (1929).

Descriptors: *Ohio, *Remedies, *Obstruction to flow, *Backwater, Barriers, Watercourses (Legal), Damages, Flooding, Dams, Adjudication procedure, Judicial decisions, Legal aspects.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought an action for damages and an injunction against defendant's obstruction of two watercourses which resulted in water backing up on plaintiff's property. Defendant denied the allegations, but the trial court granted plaintiff an injunction. The Supreme Court of Ohio, reversing for procedural errors, ruled that equitable relief to restrain obstructions to flow is not barred even though there may be an adequate remedy at law. (Barker-Florida)
W71-01001

MCKIERNANN V GRIMM (OBSTRUCTION OF NATURAL WATERCOURSE).

165 NE 310-311 (Ohio 1928).

Descriptors: *Ohio, *Obstruction to flow, *Alteration of flow, *Diversion, Natural flow, Natural flow doctrine, Barriers, Buildings, Relative rights, Boundaries (Property), Watercourses (Legal), Intermittent streams, Damages, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought an injunction against defendant neighboring landowner for the wrongful obstruction of a natural watercourse. Defendant had constructed a garage on his property and in so doing had obstructed the watercourse and caused the water to be diverted onto plaintiff's land. The trial court granted the injunction. In affirming, the appellate court ruled that proof of obstruction of a natural watercourse was sufficient for injunction. The court further ruled that the general rule of dominant and servient tenements does not apply when a servitude is created artificially. (Barker-Florida)
W71-01002

SICILIANO V BARBUTO (DISCHARGE OF COLLECTED WATER).
265 Mass 390, 164 NE 467-469 (1929).

Descriptors: *Massachusetts, *Snow, *Rain, *Buildings, Roofs, Precipitation (Atmospheric), Water, Damages, Drains, Flow, Remedies, Judicial decisions, Legal aspects, Discharge (Water).

Plaintiff landowner brought an action for injunction and damages against defendant neighboring landowner for the wrongful collection and discharge of water onto plaintiff's land. The trial court found that defendant maintained buildings whose eaves and drain troughs discharged water from rain and snow onto plaintiff's land. On appeal, the Supreme Judicial Court of Massachusetts held that such action was indeed tortious and affirmed the judgment for plaintiff. (Barker-Florida)
W71-01003

UNITED PAPER BOARD CO V IROQUOIS PULP AND PAPER CO (FLASHBOARDS WITHIN MEANING OF CREST OF A DAM).
164 NE 594-595 (NY 1928).

Descriptors: *New York, *Dams, *Floodgates, *Spillway crests, Adjudication procedure, Flow, Flow control, Judicial decisions, Legal aspects.
Identifiers: *Flashboards.

In a per curiam decision wherein the facts were not presented, the Court of Appeal of New York ruled that when a deed to water rights includes a provision that water shall flow over the crest of a dam, the top flashboards of the dam are to be considered as the crest of the dam. (Barker-Florida)
W71-01004

NANCE V MERCHANTS' FERTILIZER PHOSPHATE CO (LIABILITY FOR NEGLIGENCE IN POLLUTING A STREAM).

200 NC 702, 158 SE 486-490 (1931).

Descriptors: *North Carolina, *Water pollution, *Water pollution effects, *Water pollution sources, Judicial decisions, Adjudication procedure, Legal aspects, Streams, Surface waters, Damages, Remedies, Industrial wastes, Poisons, Toxins, Mortality, Fertilizers, Agricultural chemicals, Agriculture, Livestock, Animals, Domestic animals, Hogs, Stock water.

Defendant company's fertilizer plant discharged noxious chemicals into a stream near where plaintiff kept his hogs. During a period of heavy rainfall, the stream overflowed, depositing noxious substances in plaintiff's pasture. On two occasions a number of plaintiff's hogs died after consuming the polluted water. Plaintiff sought damages for defendant's allegedly negligent discharge of such chemicals. The trial court awarded plaintiff damages. Defendant contended on appeal that the deaths resulted from an act of God for which defendant was not liable. Defendant contended that the rainfall preceding the deaths was unprecedented. The Supreme Court of North Carolina affirmed. When negligence concurs with an act of God in producing an injury, the party guilty of such negligence shall be held liable for the consequences if the injury would not have occurred but for his failure to exercise due care. Defendant was obliged to use its property with care and was liable for the consequences of its negligence. (Dye-Florida)
W71-01005

HOLTON V NORTHWESTERN OIL CO (SURFACE WATER DRAINAGE AS NUISANCE).
201 NC 744, 161 SE 391-394 (1931).

Descriptors: *North Carolina, *Surface drainage, *Drainage, *Surface runoff, Adjudication procedure, Judicial decisions, Legal aspects, Damages, Runoff, Drainage water, Grading, Flow, Surface waters, Relative rights, Ditches, Drainage effects, Effects, Overlying proprietor, Remedies.

Defendant operated a service station on high ground adjacent to plaintiff's property and dwelling house. Water from defendant's ice box and water barrel drained into a ditch, which became filled with pop bottles, and overflowed onto plaintiff's property. Plaintiff sought damages and abatement of the drainage as a nuisance. The Supreme Court of North Carolina affirmed the trial court's judgment of non-suit. The court stated that the owner of lower land is obliged to receive surface water which falls on higher land and naturally flows onto lower land. (Dye-Florida)
W71-01006

COLLIER V GARNER (EQUITABLE RELIEF IN BOUNDARY DISPUTES).
170 SE 353-354 (Ga 1933).

Descriptors: *Georgia, *Boundary disputes, *Ownership of beds, *Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Land, Real property, Streams, Streambeds, Beds, Banks, Land tenure, Bed under water, Boundaries (Property).

Defendant landowner owned property containing a creek. Defendant granted part of the land extending to one side of the creek to plaintiff's predecessor in title. When plaintiff attempted to remove rocks from his side of the stream, defendant interfered with the removal, claiming title to the entire stream. Plaintiff sued in equity to quiet title in the property to the thread of the stream. The trial court overruled defendant's demurrer, relying on a construction of the deed to plaintiff's predecessor giving plaintiff title to the thread of the stream. The Supreme Court of Georgia reversed. Adequate remedy was available to plaintiff through an action

at law in ejectment. The court stated that a court of equity will not quiet title where an adequate remedy exists at law. Plaintiff's complaint thus failed to state a cause of action, and defendant's demurrer should have been sustained. (Dye-Florida)
W71-01007

CHESAPEAKE AND O RY V CALDWELL (LIABILITY FOR DAMAGES RESULTING FROM INSUFFICIENT DRAINAGE THROUGH RAILWAY EMBANKMENT).
213 Ky 410, 281 SW 176-178 (1926).

Descriptors: *Kentucky, *Drainage, *Obstruction to flow, *Railroads, Adjudication procedure, Judicial decisions, Legal aspects, Barriers, Diversion, Relative rights, Drains, Culverts, Surface waters, Compensation, Damages, Drainage effects.

Plaintiff owned property adjacent to defendant railroad company's tracks. Defendant coal company constructed a switch from the main railroad tracks to its mines. The switch tracks were on a 6-foot embankment. Plaintiff brought an action for damages and other relief when insufficient drainage resulted in damage to plaintiff's property. Plaintiff obtained a judgment ordering defendants to improve culverts beneath the tracks. The instant action against the same defendants was brought when the enlarged culverts also proved inadequate. The trial court ruled for plaintiff on the basis of negligence by both defendants. Defendant railroad contended that it was not liable since the switch and culverts were built and maintained solely by defendant coal company. Defendant coal company claimed that the method of determining the proper amount of damages was improperly stated to the jury as being the diminution of value of the property rather than the decrease in its rental or use value. The court reversed as to defendant railroad and reversed and remanded as to defendant coal company for a new evaluation of damages. (Dye-Florida)
W71-01008

SPOO V GARVIN (OBLIGATION OF LOT OWNER TO GUARD AGAINST LOOSE SOIL FALLING ONTO ADJACENT LOT WHILE MAKING IMPROVEMENTS).
236 KY 113, 32 SW2d 715-717 (1930).

Descriptors: *Kentucky, *Damages, *Surface runoff, *Excavation, Judicial decisions, Legal aspects, Drainage, Drainage practices, Runoff, Surface waters, Embankments, Impounded water, Impoundments, Overland flow, Washouts.

Plaintiff landowner sought to recover damages and to enjoin defendant adjacent landowner from allowing surface water to wash over onto her property and carry with it loose soil from defendant's lot. Defendant denied plaintiff's allegations and by counterclaim contended that plaintiff's predecessor had lowered the level of her property by excavation so near his property line so as to cause his property to crumble over into plaintiff's lot during rainy periods. The court refused to hold plaintiff liable for an act of her predecessor. Plaintiff was entitled to remove soil that fell onto her lot, but was liable for the value of that soil appropriated for her use. The court stated that defendant, knowing drainage from his lot would fall on the adjoining lot when he was making improvements, should have guarded against loose dirt being carried thereto. The trial court had dismissed both claims, but had subsequently awarded nominal damages to defendant. The trial court's judgment was affirmed. (Price-Florida)
W71-01009

STATE V HUFFMAN (AVULSION EFFECTS NO CHANGE IN BOUNDARY LINES OF PROPERTY ABUTTING ON STREAM).
2 SW2d 582-584 (Mo 1938).

Descriptors: *Missouri, *Accretion (Legal aspects), *Avulsion, *Boundaries (Property), Boundary disputes, Missouri River, Channel morphology, Legislation, Legal aspects, Judicial decisions, Bank erosion, Erosion, Relative rights, Local governments.

In 1875 the boundary line between two counties was the middle of the Missouri River. The course of said river changed imperceptibly until 1915. At that time, the river abandoned its old channel suddenly by the process of avulsion. The dispute herein was whether the 1875 boundary line or the line established in 1922 to be in the center of the then abandoned river bed as it was in 1915, was to prevail. Plaintiff state argued for the 1875 boundary based on constitutional and statutory arguments, while defendant argued for the 1922 boundary based on case law and the common law. The court stated that where land is bordered on running water, and the banks gradually change by accretion, the stream continues to be the boundary line. However, where such a change occurs suddenly by avulsion, the boundary line remains in the center of the abandoned river bed. Therefore, the 1922 boundary set up in the abandoned river bed as it existed in 1915 following shifts due to accretion prevailed. The trial court's judgment for defendant was affirmed. (Price-Florida)
W71-01010

DOWNEY V PHELPS (TEST FOR DETERMINING WHETHER A TRACT IS DOMINANT OR SERVIENT TO ANOTHER.
208 NW 499-503 (Iowa 1926).

Descriptors: *Iowa, *Dikes, *Natural flow doctrine, *Overlying proprietors, Ditches, Levees, Natural flow, Floodwaters, Crop response, Drainage, Drainage effects, Drainage practices, Channel morphology, Ponds, Embankments, Discharge (Water), Overflow, Backwater, Diversion structures, Judicial decisions, Legal aspects, Land reclamation, Obstruction to flow.

Plaintiff landowners sought to enjoin defendants from maintaining a levee, or dike, on defendants' land, which allegedly obstructed the flow of water from plaintiffs' land. Defendants contended the damage to plaintiffs' land was due to natural causes. To be entitled to the relief sought, the court said that plaintiffs' would have had to show their land to be dominant to defendants' and that defendants' dike had impeded the natural flow of water from plaintiffs' property. All but one plaintiff had failed to prove their lands dominant to those of defendants', and as to him so proving, it was found that defendants' dike had no adverse effect on his land. As to which is the servient and which is the dominant estate in regard to the ordinary surface waters is determined by the relative elevation of the respective tracts, although it may be true that in times of flood both are entirely submerged and inundated. The trial court's judgment for plaintiffs was reversed. (Price-Florida)
W71-01011

JOHNSON V CHICAGO B AND Q RR (WAIVER OF RIGHT TO DAMAGES CAUSED BY OBSTRUCTION TO FLOW OF NATURAL DRAIN).
211 NW 842-846 (Iowa 1927).

Descriptors: *Iowa, *Obstruction to flow, *Easements, *Diversion, Damages, Surface waters, Natural flow, Natural flow doctrine, Bridges, Railroads, Missouri River, Right-of-way, Ditches, Drainage, Overflow, Diversion losses, Crop response, Drainage districts, Judicial decisions, Legal aspects, Real property, Land tenure.

Plaintiff brought action for damages allegedly caused by the obstruction of surface waters by defendant's railroad bridge. Plaintiff demurred to defendant's answer that it had been granted by plaintiff's predecessor in title the right to continue to maintain the bridge as it was originally constructed. It was so maintained at the institution of this action. The court concluded that plaintiff had the duty to inquire as to defendant's rights at the time plaintiff bought his adjacent property. A landowner may waive his rights to damages resulting from an obstruction causing a diversion of water from its natural course. Such a waiver was given to defendant by plaintiff's predecessor in title, and had plaintiff made inquiry in the exercise of reasonable diligence, he would have discovered the facts which he claimed had no binding effect on him. The judgment for defendant was affirmed. (Price-Florida)
W71-01012

VICK V STREHMEL (RIGHT OF UPPER PROPRIETOR TO CAST SURFACE WATERS OFF HIS PROPERTY).
222 NW 307-309 (Wis 1928).

Descriptors: *Wisconsin, *Surface drainage, *Surface waters, *Surface runoff, Drainage, Drainage water, Overland flow, Runoff, Watersheds (Basins), Drains, Flow, Natural flow, Judicial decisions, Relative rights, Overlying proprietor, Legal aspects, Flow augmentation.

Plaintiff landowner brought an action to enjoin defendant from using a drain to divert surface waters from defendant's land onto plaintiff's land. Plaintiff contended that the drain was used to remove a gathering of surface waters from defendant's land and that such surface waters would not have otherwise been cast upon plaintiff's land by any natural course. Defendant contended that surface water from his land flowed in the natural course of drainage to plaintiff's land and that the drain did nothing but hasten such flow. The court held that an upper proprietor has a right to rid his lands of surface waters by permitting or causing the same to flow in the natural drainage course onto adjoining lands. The court also held that such a proprietor can construct drains to carry surface waters where no new watershed is created. Thus from the evidence in the case, the court ruled that defendant had not acted improperly in constructing the drain to assist the flow of surface water along its natural course, even though the drain increased the water's flow. (Snow-Florida)
W71-01013

NORDLUM V GREAT NORTHERN RY (ALTERATION OF NATURAL COURSE OF DRAINAGE WATER BY RAILROAD BED CONSTRUCTION).
225 NW 145-146 (Minn 1929).

Descriptors: *Minnesota, *Surface drainage, *Surface waters, *Surface runoff, Drainage, Drainage water, Watersheds (Basins), Flow, Natural flow, Alteration of flow, Obstruction to flow, Damages, Flooding, Flood damage, Ponding, Judicial decisions, Overland flow, Railroads, Road banks, Adjudication procedure, Legal aspects.

Plaintiff brought an action to recover damages for alleged negligence by defendant railroad company. Plaintiff contended that defendant, by constructing a railroad bed adjacent to this property had altered the natural course of drainage which cased water to accumulate upon his land, to flood it and to injure his crops. Defendant contended that the railroad bed at no time was the cause of any flooding upon plaintiff's lands. The court reviewed the record and ruled that there was no evidence tending to show that the railroad bed interfered with the course of drainage. Thus the verdict for plaintiff was reversed and a new trial ordered. (Snow-Florida)
W71-01014

HICKEL V CHICAGO R I AND P RY (ALTERATION OF NATURAL COURSE OF DRAINAGE
227 NW 419-421 (Iowa 1919).

Descriptors: *Iowa, *Surface drainage, *Culver *Alteration of flow, Watercourses (Legal), Flo Drainage, Drainage water, Surface wate

ersheds (Basins), Conduits, Conveyance structs, Drains, Judicial decisions, Railroads, Roadks, Natural flow, Overland flow, Diversion, ural flow doctrine, Legal aspects.

suit to restrain defendant railroad company altering the natural course of drainage, plaincontended that defendant, by constructing a ert through a railroad bed, cast drainage water his land. Plaintiff contended that but for the ert altering the natural course of drainage, such r would have not flowed upon his land. Defen- contended that the natural course of the nage was across plaintiff's land and that, were it for defendant's roadbed, the drainage would in se be cast upon plaintiff's land. Thus defendended that the culvert was merely correcting natural drainage course which had been altered e construction of the roadbed. The court held the evidence indicated that the natural course rainage in that area was across plaintiff's land. s the construction of the culvert to restore the ral course, previously altered by the roadbed, proper. (Snow-Florida)
-01015

NAM V KINNEY (PUBLIC RIGHT TO FISH N NON-NAVIGABLE LAKE).
Mich 410, 227 NW 741-743 (1929).

criptors: *Ownership of beds, *Michigan, n-navigable waters, *Lakes, Fishing, Mean-, Navigable waters, Navigation, Riparian rights, cial decisions, Lake beds, Inland waterways, shores, Shores, Federal Government, Sur-, Public rights, Riparian land, Legal aspects, d tenure.

n action for an injunction, plaintiff sought to ain defendants from trespassing and fishing a lake on his property. Plaintiff contended the inland lake was subject to his sole control at he was the owner of all the land surrounding lake. Defendants contended that they had a of access to the lake and a right to fish upon ake, such rights being the rights of the general ic. Defendants contended that because the had been meandered by Federal Government eyors, the lake was thus a public navigable , which gave the public a right to navigate it to fish in its waters. The court held that the was not navigable in fact in that it was not ble of being used for purposes of commerce, e or travel. The fact that the lake had been ndered was immaterial. The court held that the rian proprietor owning all the shore line of an d lake is the owner of the land underneath the and has the exclusive right to the use of the . Defendants were thus restrained from invadplaintiff's lake. (Snow-Florida)
-01016

ARD OF SUPERVISORS V BOARD OF SUVISORS (COST SHARING BY ADJACENT AINAGE DISTRICTS).
NW 14-26 (Iowa 1932).

criptors: *Iowa, *Drainage districts, *Cost ing, *Drainage systems, Governments, Con-ed drainage, Ditches, Drainage effects, nage programs, Land management, Running rs, Surface waters, Water control, Water agement (Applied), Remedies, Legal aspects, allocation, Judicial decisions, Administrative cies.

ntiff lower drainage district sought a writ of damus to compel defendant upper drainage ict to assess the land within defendant district rder to pay a portion of the drainage improvet cost in plaintiff district. Plaintiff contended the landowners in defendant district impliedly ertook to assume the burden of paying a por- of the cost of improving the ditches of the r district by organizing the upper district and ing improvements which would necessarily lt in an increased flow to the lower district. Defendant contended that statutes providing for assessment to compensate for increased burdens on lower districts required that notice be given to those who might be assessed. Defendant further contended that no notice was given landowners residing in the upper district. The Supreme Court of Iowa held that the upper landowners were assessed with respect to the ratio of the district's outflow according to the statute and that no notice was required by the statute to those whose lands would not be taken for a right-of-way. The court ordered defendant to collect funds for the payment of their ratable portion of burden in the lower district's drainage system. (Quesada-Florida)
W71-01017

DALY V STATE (EXTRAORDINARY RAINFALL IS NO DEFENSE TO NEGLIGENCE IN MAINTAINING A CANAL).
226 App Div 154, 235 NYS 331-335 (1929).

Descriptors: *New York, *Floods, *Canals, *Rain water, Legal aspects, Judicial decisions, Remedies, Damages, Channels, Canal embankments, Drains, Ditches, Floodwater, Rain, Streams, Natural flow, Water injury, Farms, Crops, Streamflow, Forecasting, State Governments, Overflow, Excessive precipitation.

Plaintiff sued for damages which resulted to his crops when water from defendant state's Champlain Canal overflowed onto his farm. Plaintiff alleged that defendant was negligent in maintaining the unused canal. Defendant contended the overflow was caused by an extraordinary rainfall and that the overflow might have occurred even if the canal had not been there. The court, in reversing the trial court's judgment for defendant, held that extraordinary rainfall is not a defense to negligence although an act of God would be. The court also held that any consideration of whether the flooding would have occurred without the canal's presence was speculation. (Morris-Florida)
W71-01018

MANLEY V NEW YORK CENT RR (LIABILITY FOR IMPROVEMENTS WHICH BLOCK NEIGHBOR'S SURFACE DRAINAGE).
227 App Div 206, 237 NYS 273 (1929).

Descriptors: *New York, *Surface waters, *Drainage, *Repulsion (Legal aspects), Legal aspects, Judicial decisions, Remedies, Damages, Boundaries (Property), Surface runoff, Drainage water, Drainage pattern (Geologic), Railroads, Obstruction to flow, Barriers, Natural flow, Relative rights.

Plaintiff sought damages from defendant railroad company, alleging that defendant was blocking the flow of surface water off plaintiff's property. Defendant answered that any blockage occurred in the improvement and maintenance of its railroad lines. The natural flow of the surface waters was from plaintiff's land on and through defendant's land until defendant made the improvements. In a per curiam decision which reversed a lower court decision for plaintiff, the court held that defendant had a right to improve his property, even though it blocked the waters, as long as it did not act in bad faith or negligently. (Morris-Florida)
W71-01019

DOUNCE V CITY OF ELMIRA (LIABILITY FOR FLOOD DAMAGE).
237 App Div 379, 261 NYS 757-761 (1932).

Descriptors: *New York, *Floods, *Landfills, Legal aspects, Grading, Judicial decisions, Damages, Remedies, Local governments, Land forming, Streams, Rainfall, Streamflow, Channels, Floodwater, Drainage, Natural flow, Bridges, Flood damage, Surface waters, Excessive precipitation.

Plaintiff landowner sued defendant city for damages which resulted from the flooding of his land after defendant raised the level of certain land on the opposite side of a stream and built bridges over it. Plaintiff asserted that before defendant filled in such low-lying land, that land and not plaintiff's was flooded during flood season. Defendant insisted the flooding was caused by abnormal rainfall and not by its negligence. The court reversed a lower court judgment for plaintiff. The court found both sides of the stream had been filled so as to change the natural conditions and that the stream's floodwaters did not flow in defined channels but became surface waters. The court found defendant was not negligent in filling its own land or building the bridges, and that any damages to plaintiff were damnum absque injuria. (Morris-Florida)
W71-01020

JOHNSON V HUME (CONSTITUTIONALITY OF STATUTE GOVERNING CHANGE OF PROPERTY BOUNDARY DUE TO ACCRETION OR CHANNEL EROSION).
137 SE 56-57 (Ga 1927).

Descriptors: *Georgia, *Accretion (Legal aspects), *Boundaries (Property), *Channel erosion, Legislation, Legal aspects, Judicial decisions, Boundary disputes, Prescriptive rights, Land tenure, Real property, Non-navigable waters, Streams, Riparian rights, Riparian land, Riparian waters, Ownership of beds.

Plaintiff riparian owner sued to enjoin his grantor from trespassing on plaintiff's land. In reversing a judgment for defendant, the court held that a Georgia statute, which provided that property boundaries comprised of non-navigable streams changed when the channel of the stream gradually changed and that accretions on either side of the stream accrued to the adjacent landowner, did not violate the due process clauses of the state and federal constitutions. (Liptak-Florida)
W71-01021

COUCH V CLINCHFIELD COAL CORP (COAL COMPANY'S LIABILITY FOR DIVERTING FLOW OF PERCOLATING WATER).
139 SE 314-317 (Va 1927).

Descriptors: *Virginia, *Percolating water, *Alteration of flow, *Mining, Groundwater, Land subsidence, Overlying proprietor, Water sources, Water supply, Wells, Groundwater movement, Water wells, Water rights, Coal mines, Excavation, Appropriation, Natural flow doctrine, Preferences (Water rights), Judicial decisions, Legal aspects, Diversion.

Plaintiff landowner brought action against defendant coal company to recover damages resulting from a subsidence of defendant's adjacent property which caused plaintiff's well to dry up. Plaintiff contended that he was entitled to lateral and subjacent support and to the natural flow of the underground percolating water beneath his property. Plaintiff alleged that defendant was negligent in its mining operations, thereby causing the subsidence and the diversion of the water. Defendant contended that the doctrine of lateral and subjacent support was not applicable since plaintiff's property was not disturbed and no mining was done under his property. Furthermore, there was no liability for diverting undefined underground percolating water. Affirming a judgment for defendant, the court held that lateral and subjacent support did not apply. Moreover, no cases had been found denying landowners the right to divert percolating water--even though the diversion ruins a neighbor's well or underground spring. (Liptak-Florida)
W71-01022

MOODY V BURRELL (REMEDY FOR POLLUTION OF WATER SUPPLY BY DOMESTIC SEWAGE SYSTEM).
146 SE 753 (Ga 1929).

Descriptors: *Georgia, *Water pollution, *Domestic wastes, *Sewage disposal, Pollutants, Water pollution sources, Pollution abatement, Wastes, Water quality, Domestic water, Potable water, Water supply, Sewage, Septic tanks, Sewage systems, Spring water, Legal aspects, Judicial decisions, Remedies.
Identifiers: Injunction (Prohibitory).

Plaintiff hotel operator sued to restrain defendant property owner from constructing a septic tank and sewage system which allegedly would contaminate a spring which served as plaintiff's water supply for her hotel guests. Plaintiff further contended that the sewage system would infect her water supply and was therefore a nuisance. Defendant offered evidence that plaintiff's water supply would not be affected. In view of the sharply conflicting evidence, the court affirmed the order denying plaintiff an interlocutory injunction and dissolving the temporary restraining order. (Liptak-Florida)
W71-01023

MCNABB V HOUSER (DIVERSION OF WATER FROM A NON-NAVIGABLE STREAM).

156 SE 595-599 (Ga 1931).

Descriptors: *Georgia, *Division, *Natural flow doctrine, *Non-navigable waters, Streams, Streamflow, Obstruction to flow, Diversion structures, Alteration of flow, Riparian rights, Riparian land, Riparian waters, Ditches, Dams, Mills, Mill dams, Sawmills, Hydroelectric plants, Legal aspects, Judicial decisions, Remedies.
Identifiers: Injunction (Prohibitory).

Plaintiff riparian owner sued to enjoin defendant riparian owner from diverting water from a non-navigable stream flowing from defendant's property through plaintiff's property. Plaintiff contended that the ditch defendant was digging would interrupt the natural flow of the stream and would render plaintiff's corn mill, sawmill, cotton gin and hydroelectric plant inoperable. Defendant contended that there was more than eough water in the stream to supply plaintiff's several operations and defendant's mining operations and that plaintiff was estopped from complaining of the diversion after standing by silently while defendant expended large sums of money constructing the ditch. Affirming a judgment for plaintiff, the court held that any diversion was an interference with plaintiff's right to the natural flow of the stream and that plaintiff was not estopped from seeking an injunction since he was under no duty to speak and defendant had not relied on plaintiff's silence when he constructed the ditch. (Liptak-Florida)
W71-01024

INTERNATIONAL SHOE CO V GIBBS (POLLUTION OF STREAM BY MANUFACTURE).

36 SW2d 961-963 (Ark 1931).

Descriptors: *Arkansas, *Water pollution, *Industrial wastes, *Damages, Cattle, Pastures, Streams, Sewage, Septic tanks, Sewage disposal, Water pollution sources, Water pollution effects, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff landowner sued defendant shoe manufacturer for pollution injury to a stream crossing plaintiff's land. Plaintiff rented the land for use as a cow pasture. A small dwelling on the property was also rented. Defendant constructed a septic tank on its adjacent land, and the tank overflowed into the stream. Plaintiff alleged that the sewage caused offensive odors, so that cattle refused to drink it, and that the dwelling was made uninhabitable. Accordingly, defendant contended the value of his land was diminished. Defendant argued that the injury was temporary rather than permanent and that the jury award was excessive. The court noted that defendant had not previously raised the question of permanent injury and, therefore, held that defendant could not complain on appeal that the injury was temporary. The jury verdict was held not to be excessive, and lower court's judgment for plaintiff was affirmed. (Hart-Florida)
W71-01025

PERRY V SIMPKINS (POLLUTION OF FARM AND STREAM BY FLUORSPAR MINE).
260 Ky 151, 84 SW2d 35-38 (1935).

Descriptors: *Kentucky, *Water pollution, *Mine wastes, *Farms, Agriculture, Damages, Water pollution effects, Water pollution sources, Pollutants, Crops, Flooding, Flood damage, Hydraulic mining, Sedimentation, Sediment discharge, Judicial decisions, Legal aspects, Adjudication procedure.
Identifiers: Injunction.

Plaintiff farm owner sued defendant fluorspar mining operator for pollution injury to a stream crossing plaintiff's land. Defendant's mining wastes discharged into the stream and caused the stream to fill with sediment. When the stream overflowed plaintiff's property, pollutants were deposited on the farmland. Defendant contended that no damage was proven and that the injunction granted by the chancellor below was too broad. Reviewing the chancellor's fact findings, the court held that the evidence sustained the finding of permanent damage. Finding that it only prohibited defendant from further pollution of the stream, the injunction was upheld by the court. (Hart-Florida)
W71-01026

FIRE DIST NO 1 V GRANITEVILLE SPRING WATER CO (PROPOSED DIVERSION OF SPRING WATERS AS A VIOLATION OF LOWER LANDOWNER'S RIPARIAN RIGHTS).

152 A 42-44 (Vt 1930).

Descriptors: *Vermont, *Percolating water, *Riparian rights, *Reasonable use, Natural flow, Relative rights, Groundwater, Surface waters, Diversion, Obstruction to flow, Water utilization, Springs, Streams, Reservoirs, Alteration of flow, Competing uses, Legal aspects, Surface-groundwater relationships, Judicial decisions.

Plaintiff sought to enjoin defendant from diverting water from a stream, claiming that a proposed development of such spring on defendant's property would result in the stream being prevented from flowing onto plaintiff's property. The court recognized that under Vermont law a landowner is the exclusive owner of all groundwater beneath his property. However, when the water comes to the surface and becomes part of a flowing stream, the landowner is held to a reasonable use standard in utilization of this water. Therefore, the court held that while plaintiff had no rights in the percolating waters under defendant's property, it did have a legal interest in the flowing spring waters against anyone who unreasonably diverted water in violation of plaintiff's riparian rights. The case was remanded for a factual determination of whether defendant's proposed diversion was reasonable. (Caldwell-Florida)
W71-01027

SCHLICHTKRULL V MELLON-POLLOCK OIL CO (ILLNESS CAUSED BY POLLUTION OF WELL).
301 Pa 560, 152 A 832-834 (1930).

Descriptors: *Pennsylvania, *Water pollution, *Saline water intrusion, *Water wells, Oil industry, Public health, Oil wells, Drilling, Oil fields, Saline water, Saline water-freshwater interfaces, Wells, Well casings, Groundwater, Water supply, Percolating water, Subsurface waters, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff landowner brought suit for damages against defendant oil company. Defendant had drilled an oil well and thereby caused salt to accumulate in plaintiff's water well. Plaintiff's wife became ill and plaintiff claimed the illness was caused by the salt in the water. The Supreme Court of Pennsylvania, reversing the trial court's decision for plaintiff, ruled that before an action for negligence in drilling an oil well would lie, danger to public health must have been foreseeable. Plaintiff had not met the burden of proof requisite to such an action. (Barker-Florida)
W71-01028

SISTERS OF ST JOSEPH CORP V ATLA SAND, GRAVEL AND STONE CO (FLOO DAMAGE RESULTING FROM NEGLIGENTL CONSTRUCTED CULVERT).
120 Conn 168, 180 A 303-07 (1935).

Descriptors: *Connecticut, *Culverts, *Surface r noff, *Overflow, Surface drainage, Flood damag Drainage engineering, Legal aspects, Relati rights, Natural flow, Channel flow, Flow augment tion, Drainage practices, Repulsion (Leg aspects), Damages, Judicial decisions, Cos Remedies, Streams, Riddance (Legal aspects).

Defendant corporation had constructed a culve through which a creek ran upon leaving plaintif land. Plaintiff claimed the culvert was too small a was negligently constructed, thereby causing su face runoff to back up onto plaintiff's property. D fendant contended that most of the flood dama had been caused by increases of surface water flo into the creek resulting from street paving and la ing of drains by the city. Finding no evidence dicating that any of plaintiff's damage was due the city's actions, the court rejected defendan claim. The court stated that defendants had a du to keep a channel which would carry off the wat of the creek, even in times of heavy rain, in amount equivalent to the natural capacity of creek. The court rejected defendant's claim t the cost to it of repairing the culvert would be m than the value of any corresponding relief to plaintiff. A lower court decision for the plain was affirmed. (Caldwell-Florida)
W71-01029

DRUCE V BLANCHARD (NATURAL FLOW DRAINAGE CREATES EASEMENT).
338 111 211, 170 NE 260-264 (1930).

Descriptors: *Illinois, *Drainage, *Soil-water-p relationships, *Water table, Lakes, Drainage wa Drainage effects, Surface waters, Topography, water, Subsurface drainage, Excess water (So Groundwater, Saturated soils, Water levels, W level fluctuations, Easements, Ditches, Fa Recreation, Legal aspects, Judicial decisi Remedies, Dams.

Plaintiff farmers sought an injunction to keep fendants from constructing a dam for the pur of raising the water level of a certain lake and proving it for recreational purposes. Plain claimed the increase in the water level would in fere with the drainage from their farms by ra the water table. Defendants contended that dit already had lowered the lake's level and that it impossible to determine what the natural level The Supreme Court of Illinois, in reversing lower court's decision, held that an injun should issue. The court stated that the owner dominant heritage has a natural easement fo flow of surface waters and the owner of the ser heritage cannot interfere therewith. (Mc Florida)
W71-01030

LOGAN GAS CO V GLASCO (UNDERGRO WATER MUST BE IN CHANNEL TO BE JECT TO RIPARIAN RIGHTS).
122 Ohio St 126, 170 NE 874-877 (1930).

Descriptors: *Ohio, *Subsurface waters, *Gro water movement, *Riparian rights, Springs, sian wells, Spring waters, Underground str Percolating water, Water sources, Riparian w

rian land, Water supply, Water shortage, ndwater, Riparian water loss, Diversion s, Channels, Legal aspects, Judicial decisions, ages, Remedies.

tiff farmer sued defendant company for ages suffered by the reduction in flow of a g on plaintiff's property. Plaintiff asserted that spring had furnished an abundant supply of r until defendant, while drilling a gas well a mile away, also drilled a water well. The eme Court of Ohio, in reversing the lower t's verdict for plaintiff, held that even conced- hat defendant's well struck a vein of water ng plaintiff's well, there could be no recovery ss it was clearly shown that the underground r was in a defined and known channel. Chan- vater is subject to riparian rights underground ell as when it is on the surface. But un- round water is presumed to be percolating, and wner of land may use the percolating water r his land at his own will. (Morris-Florida)
-01031

DDOCK V CITY OF SPRINGFIELD OODING BY SURFACE WATER INAGE).
Mass 103, 183 NE 148-149 (1932).

riptors: *Massachusetts, *Flooding, *Ponding, face runoff, Drainage water, Riddance (Legal cts), Slopes, Snowmelt, Time of concentration, ace drainage, Cities, Ice skating, Landfills, ling, Judicial decisions, Legal aspects, Natural doctrine, Alteration of flow, Relative rights, , Rainfall, Impact (Rainfall).

tiff landowner sued defendant city for ages caused by surface water draining from de- ant's lot onto plaintiff's lot. Plaintiff and defen- owned contiguous lots fronting on a street. ndant constructed a sidewalk along his lot al inches higher than the grade established by nicipal survey. Defendant then filled in the lot the sidewalk to the middle, creating a low which filled with frozen water in the winter cient for a skating pond. With the spring thaw, accumulated water flowed onto plaintiff's lot, by flooding his cellar. Plaintiff contended that ndant was under a duty to prevent his injury. court noted that, in absence of an easement or ement, neither owner could regulate the flow rface water. The retention of the water on de- ant's lot was determined to be immaterial. The t stated that defendant was free to grade and is lot as he chose so long as water was not col- d and discharged in a channel over plaintiff's nd held that defendant was not liable for plain- injury. The lower court's decision for defen- was affirmed. (Hart-Florida)
-01032

PLE EX REL CARLSTROM V HATCH (TI- DISPUTE TO LAND WITHIN IM- PERLY ESTABLISHED MEANDER LINES).
Ill 586, 183 NE 610-613 (1932).

riptors: *Illinois, *Lakes, *Meanders, *Boun- disputes, State governments, State jurisdic- Water resources development, Boundaries perty), Swamps, Surveys, Mapping, Maps, l aspects, Judicial decisions, Land tenure, Real erty.
tifiers: *Title disputes.

tiff state brought action to quiet title in lands by defendant swamp owner. The disputed land originally within a meander line established by ited States surveyor. However, after discovery the meander line was improperly established rc there was no navigable lake, a new survey plat had been made. At that time, title to the was in the United States, who conveyed it to tiff; plaintiff reconveyed to the local county. ndant claimed title by adverse possession from county. Plaintiff contended that all lands within meander line were held in trust for the people. The court agreed that this was generally true, but noted that a surveyor, by drawing a meander line on a survey, could not create a lake where one did not exist. The new survey had nullified the meander line. Holding that the further conveyance to the county was valid, and that defendant had established adverse possession against the county, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01033

GAUVREAU V GULF REFINING CO (LIABILITY FOR POLLUTION OF WATER BY LEAKING GASOLINE TANK).

288 Mass 54, 192 NE 220 (1934).

Descriptors: *Massachusetts, *Water pollution, *Gasoline, *Leakage, Legal aspects, Judicial decisions, Damages, Water pollution effects, Water pollution sources, Wells, Artesian wells, Poisons, Fuels, Oil, Maintenance, Repairing, Installation, Adjudication procedure.

Plaintiff wife and daughter sued defendant oil company for pollution of a well and injury to their health. Defendant had installed gasoline tanks and pumps on plaintiff's property under a contract with the husband of plaintiff. Defendant claimed the contract gave the husband the duty to maintain the tanks. The lower court instructed the jury that plaintiffs could recover from defendant only for negligent installation of the tanks, and the jury found no negligence. The Supreme Judicial Court of Massachusetts stated that the replacement of a leaky pipe by defendant was not an admission of liability and held that the trial court's instruction was proper. (Morris-Florida)
W71-01034

ROOT REFINERIES, INC V ROBERTSON (POLLUTION OF FARM STREAM BY OIL REFINERY).
3 SW2d 57-58 (Ark 1928).

Descriptors: *Arkansas, *Water pollution, *Oil industry, *Dairy industry, Oil, Oil wastes, Oily water, Water pollution sources, Compensation, Damages, Streams, Water pollution effects, Pollutants, Judicial decisions, Legal aspects, Adjudication procedure, Leases, Rent, Cattle.
Identifiers: Nuisance (Continuing).

Plaintiff leaseholder sued defendant oil refinery for pollution injury to a stream which plaintiff used to water dairy cattle. Defendant had permitted oil to discharge into the stream, rendering it unfit for the cattle. Defendant contended that the stream had never been suitable for watering cattle and that the pollution was a permanent injury rather than a continuing nuisance. The appellate court, holding that the evidence clearly pointed to both the prior fitness of the stream for watering cattle and to pollution by defendant, affirmed the lower court's judgment for plaintiff. The court further held that since defendant could easily have prevented escape of oil into the stream, and since plaintiff was not the owner of the tract but a tenant at sufferance, the injury was a continuing nuisance. The proper measure of damages was the diminution in rental value. (Hart-Florida)
W71-01035

BLANKENSHIP V KANSAS EXPLORATIONS, INC (DAMAGES FOR POLLUTION OF MILLPOND BY MINE SLUDGE).

30 SW2d 471-480 (Mo 1930).

Descriptors: *Missouri, *Mills, *Sludge, *Damages, Water pollution, Mine wastes, Mill dams, Mineral industry, Mine drainage, Mining, Compensation, Streams, Ponds, Sludge disposal, Profit, Depreciation, Costs, Judicial decisions, Legal aspects, Adjudication procedure.
Identifiers: Injury (Temporary), Injury (Permanent).

Plaintiff millowner sued defendant mining company for damages from pollution. Defendant's plant was upstream from plaintiff's dam and millpond, and the mining wastes discharged into the stream by defendant caused the millpond to fill with sludge. As a result, the water power from the stream was insufficient to operate the mill. Defendant contended that the injury was temporary rather than permanent. Sustaining this assertion, the court held that the trial court should have submitted the issue to the jury. However, the court noted that plaintiff's failure to allow the stream to run the sludge from the pond did not relieve defendant from liability. Furthermore, it was found that plaintiff could recover for the lesser of: the diminution in the mill's market value, or the cost of removing the sludge. If plaintiff recovered the diminution in market value, he could not recover for lost profits. Lost profits could be recovered if removal cost was less than the diminution in market value. (Hart-Florida)
W71-01036

NORTON COAL MINING CO V WILKIE (POLLUTION OF FARM BY COAL WASHERY).

224 Ky 192, 5 SW2d 1058-1061 (1928).

Descriptors: *Kentucky, *Water pollution, *Coal mining wastes, *Damages, Water pollution effects, Water pollution sources, Pollutants, Farms, Agriculture, Crops, Crop production, Flooding, Flood damage, Coal mines, Hydraulic mining, Sedimentation, Sediment discharge, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff farm owner sued defendant coal mining company for pollution of a stream coursing plaintiff's farm, the pollution resulting from defendant's coal washery. Plaintiff alleged that the pollution sediment injured his soil and crops when the stream overflowed. The court held that: (1) in order to recover for crop damage, plaintiff must show the diminution in crop profits for each year involved; (2) court instructions should confine damage recovery to injury proximately caused by the pollution; and (3) plaintiff could not recover for injury which could have been avoided by reasonable care. The evidence presented by plaintiff was too vague and intangible to support the jury verdict, and the court therefore reversed the lower court's judgment for plaintiff. (Hart-Florida)
W71-01038

CITY OF NEW YORK V THIRD AVE RY (EXTENT OF RIPARIAN RIGHT OF ACCESS TO NAVIGABLE RIVER).
264 App Div 193, 34 NYS2d 874-876 (1942).

Descriptors: *New York, *Riparian rights, *Relative rights, *Navigable rivers, Riparian land, Riparian waters, Navigable waters, Ownership of beds, Docks, Piers, Rivers, Judicial decisions, Structures, Cities, Land tenure, Legal aspects, Access routes.

In a per curiam decision, the court considered the relative rights of plaintiff and defendant to the use of a navigable river passing through plaintiff municipality and adjacent to property owned by defendant. The court held that defendant, as a riparian owner, had a right to access to the river for the purpose of loading and unloading boats, drawing nets and the like. As an incident to those rights, the riparian owner could erect such structures as a dock or pier between the upland and the navigable water. However, inasmuch as plaintiff was the owner of the property between the upland and the navigable water, the riparian owner had no right to construct structures which would occupy a substantial area and which would be used as an extensive storage facility. The trial court's judgment for defendant was reversed, and a new trial was ordered. (Snow-Florida)
W71-01039

KUNKLE V BOROUGH OF FORD CITY (OBSTRUCTION TO FLOW OF SWAMP DRAINAGE).
305 Pa 416, 158 A 159-161 (1931).

Descriptors: *Pennsylvania, *Watercourses (Legal), *Obstruction to flow, *Drainage water, Drainage, Adjudication procedure, Natural streams, Judicial decisions, Legal aspects, Cities, Local governments, Running water, Streams, Eminent domain, Real property, Land, Surface drainage, Paving, Roads, Surface waters, Precipitation excess, Runoff, Storm runoff, Diversion, Swamps.

Plaintiff landowner brought an action in trespass contending that defendant city's street improvements had diverted a natural watercourse, causing surface water to collect on plaintiff's property. Plaintiff's property was south of a swamp and north of a public road. In times of heavy rainfall, water from the swamp flowed across plaintiff's land, beneath the road, and onto property south of the road. Defendant's road improvements obstructed drainage beneath the road and allowed water draining from the swamp to collect north of the road on plaintiff's property. Defendant contended that the route of water from the swamp was not a natural watercourse and was subject to lawful diversion. The Supreme Court of Pennsylvania agreed with defendant. A natural watercourse is one ordinarily evident and not solely dependent on rains for its existence. Water drained from this swamp only in times of extraordinarily heavy rainfall. An eminent domain action was plaintiff's proper remedy. (Dye-Florida)
W71-01040

LACKAWANNA MILLS V SCRANTON GAS AND WATER CO, (NON-RIPARIAN RIGHTS TO WATER).
150 A 633-636 (Pa 1930).

Descriptors: *Pennsylvania, *Usufructuary right, *Appropriation, *Water rights, Prior appropriation, Riparian rights, Prescriptive rights, Legal aspects, Judicial decisions, State governments, Water contracts, Regulation, Water sources, Dams, Reservoirs, Streams, Water supply, Supply, Pipelines, Industrial water, Water users, Industrial plants, Mills.

Plaintiffff companies and their predecessors in title had for years used the waters of a nearby stream to supply the water needs of their plants located on nonriparian lands. Defendant water company undertook to dam the stream at its source and executed contracts with plaintiffs' predecessors for the sale of water to them for an indefinite period at a specified price. This action was commenced by plaintiffs when the contract price was declared discriminatory, and defendant sought to charge plaintiffs the price specified by the Public Service Commission. Plaintiffs contended that the contract represented recognition by defendant of plaintiffs' property right in the water and estopped defendant from denying such a right or charging a higher rate. Defendant contended that plaintiffs' execution of the contract represented admission by plaintiffs of defendant's ownership of water rights in the stream. The court stated that plaintiffs' rights to water at the contract price ceased when the rate became discriminatory, and affirmed the lower court's judgment for defendant. (Dye-Florida)
W71-01041

DONNELLY BRICK CO V CITY OF NEW BRITAIN (POLLUTION OF RIPARIAN WATERS).
137 A 745-749 (Conn 1927).

Descriptors: *Connecticut, *Water pollution, *Riparian rights, *Flooding, Water pollution sources, Water pollution effects, Public rights, Judicial decisions, Legal aspects, Waste disposal, Sewage disposal, Adjudication procedure, Riparian land, Municipal wastes, Cities, Local governments, Streams, Real property, Damages, Domestic wastes, Drainage, Floods, Precipitation excess.

Defendant city increased the flow of water in a stream through plaintiff's property by obstructing the flow of upper branches of the stream and emptying into the stream waste waters not natural to the watershed. A heavy flood caused the polluted waters of the stream to overflow plaintiff's dikes and inundate his land. Plaintiff sought damages and an injunction restraining defendant from further polluting the stream. Plaintiff contended that he was entitled to the use of the stream containing only its natural waters and that the city's pollution of the stream constituted a continuing nuisance. Defendant contended that disposal of the sewage was a public necessity and administered with reasonable care. The Supreme Court of Errors of Connecticut reversed the lower court's judgment for defendant. Public necessity does not excuse impairment by an upper riparian owner of a lower riparian owner's right to natural flow. The pollution of the stream was a continuing nuisance for which defendant was liable in damages. The court further stated that the act of God doctrine is not applicable unless an unprecedented storm is the sole cause of injury. (Dye-Florida)
W71-01042

ROSE V SOCONY-VACCUUM CORP (POLLUTION OF STREAMS BY SUBSTANCES IN GROUNDWATER).
173 A 627-632 (RI 1934).

Descriptors: *Rhode Island, *Seepage, *Water pollution, *Percolating water, Riparian rights, Relative rights, Water pollution effects, Streams, Groundwater, Judicial decisions, Legal aspects, Riparian land, Percolation, Subsurface waters, Underground streams, Groundwater movement, Path of pollutants, Soil water movement, Oily water, Oil wastes, Water pollution sources.

Defendant operated a refinery on property adjacent to that of plaintiff. On plaintiff's property were a well and a stream used by plaintiff to water his pigs and hens. Collections of petroleum products on defendant's land entered percolating waters beneath the land and thereby passed to the water sources on plaintiff's land. This rendered the water unfit for animal consumption and caused the death of numbers of plaintiff's poultry and livestock. Plaintiff sought damages and an injunction, alleging that defendant was perpetuating a nuisance on his property. No negligence was alleged. Defendant's demurrer was sustained, and the appellate court affirmed, rejecting the doctrine of Rylands v Fletcher and stating that negligence must be shown for recovery where pollution is spread by percolating waters. The rule that one riparian owner may not injure another's use of the water was held to apply to surface streams and not to percolating waters, where the location and course of the water is generally unknown. (Dye-Florida)
W71-01043

BARRINGTON HILLS COUNTRY CLUB V VILLAGE OF BARRINGTON (DISCHARGE OF SEWAGE INTO RIPARIAN WATERS).
357 Ill 11, 191 NE 239-244 (Ill 1934).

Descriptors: *Illinois, *Water pollution, *Sewage disposal, *Cities, Riparian rights, Water pollution sources, Water pollution effects, Legal aspects, Adjudication procedure, Judicial decisions, Local governments, State governments, Municipal wastes, Domestic wastes, Streams, Eminent domain, Compensation, Riparian land, Relative rights, Public rights, Waste disposal, Pollution abatement.

Plaintiff riparian landowners sought to restrain defendant village from dumping sewage into a stream adjacent to their properties. Evidence demonstrated the existence and source of the pollution, which plaintiffs contended was a private nuisance. Defendant contended that: (1) the creation by the state of a sanitary water board removed jurisdiction from the court; (2) the value of sewage disposal should be balanced against damages to plaintiffs; and (3) defendant's sewage treatment plant was the most modern available, and (4) the village had the inherent right to discharge sewage water into the stream since it was the only water available therefor. The Supreme Court of Illinois affirmed for plaintiffs. The sanitary water board had jurisdiction over cases involving public rights only. This case involved private rights. Moreover, the city had no inherent right to dump sewage. It could not impinge upon the private rights of riparian owners without eminent domain proceedings and compensation. Plaintiff riparian owners had the right to have the stream carry only water naturally coming from their watershed. (Dye-Florida)
W71-01044

HENDRIX V ROBERTS MARBLE CO (RIPARIAN RIGHTS LIMITED TO RIPARIAN LAND).
165 SE 223-226 (Ga 1932).

Descriptors: *Georgia, *Diversion, *Riparian land, *Riparian rights, Alteration of flow, Water utilization, Pipelines, Water distribution (Applied), Pipes, Dams, Damsites, Reservoirs, Pumping, Reasonable use, Remedies, Judicial decisions, Legal aspects, Riparian water.

Plaintiff riparian landowner sold his right to use the water of a stream to a non-riparian landowner who installed a pipe to divert the flow of the water. Defendant riparian owner cut the pipe in order to have the normal flow of the stream continue, and plaintiff sought to enjoin defendant's interference. Defendant claimed that plaintiff riparian owner could not convey the right to use the water to a non-riparian owner. The Supreme Court of Georgia ruled that riparian rights are appurtenant only to lands which actually touch on the watercourse. A riparian owner may not convey to another the right to use the water on non-riparian land physically separated from the watercourse. The injunction sought by plaintiff was denied, and defendant was granted an injunction against plaintiff's maintenance of the pipeline diversion. (Barker-Florida)
W71-01045

MASONITE CORP V BURNHAM (LIABILITY FOR WATER POLLUTION).
146 So 292-296 (Miss 1933).

Descriptors: *Mississippi, *Damages, *Water pollution, *Industrial wastes, Discharge (Water), Boundaries (Property), Community development, Easements, Judicial decisions, Land tenure, Legal aspects, Proprietary power, Riparian land, Riparian rights, Riparian waters, Watercourses (Legal), Water wastes (Pollution), Domestic wastes, Sewage, Remedies, Relative rights, Wastes, Waste disposal.

Defendant corporation discharged effluent into a stream which flowed across plaintiff's property. A nearby municipality had purchased the right to pollute the same stream with sewage long before plaintiff acquired his land. It was apparent from the fact that after defendant began emptying its waste into the stream, the degree of pollution increased. In reversing the trial court's judgment for plaintiff, the Supreme Court of Mississippi held that where different parties discharge sewerage and filth into a stream which intermingles and causes an actionable nuisance, such parties are not jointly liable for damages where there is no common design or concert of action, but each is liable only for his proportion of the damages. Consequently, plaintiff's damages were limited to those attributable to the additional pollution in the stream caused by defendant's discharge of waste. (Clarke-Florida)
W71-01046

CITY OF CAPE GIRADEAU V HUNZE (MEASURE OF DAMAGES FOR STREAM POLLUTION CAUSED BY CITY SEWAGE DISTRICT).
284 SW 471-482 (Mo 1926).

criptors: *Missouri, *Water pollution, *Sewage
ricts, *Condemnation, Water pollution sources,
utants, Riparian rights, Riparian land, Riparian
er, Wastes, Municipal wastes, Sewage, Sewage
osal, Drainage systems, Cities, Damages, Com-
sation, Eminent domain.

ntiff city sought to condemn an easement
ss defendant's property for a new sewer main
to acquire the right to use a stream traversing
ndant's property for an overflow outlet for the
's sewer district. Defendant appealed from the
age award and claimed that the city's disposal
ewage into the stream would cause water pollu-
which would in turn cause great damage to
. Plaintiff argued that the stream was already
uted by slaughter houses upstream, that the
er overflow into the stream would be minimal
that riparian owners could not complain of or-
ry pollution. The court noted that riparian
ers are subject to pollution caused by natural
nage of other riparian land, but held that plain-
could not collect and discharge sewage into the
am in an amount greater than existing pollu-
. After reviewing the conflicting evidence, the
rt affirmed the damage award. (Liptak-Florida)
1-01047

**CKLER V CINCINNATI NO AND TP CO
OOF OF DAMAGES REQUIRED IN ORDER
ENFORCE COVENANT NOT TO OB-
RUCT NATURAL STREAMFLOW).**
Ky 339, 17 SW2d 194-196 (1929).

criptors: *Kentucky, *Dams, *Contracts,
ater demand, Damages, Water utilization,
er distribution (Applied), Remedies, Legal
ects, Judicial decisions, Concrete structures,
ersion structures, Reservoirs, Deflection,
arian rights, Reasonable use, Streamflow, Ob-
ction to flow, Natural flow, Alteration of flow.

ntiff lower riparian landowner sought an in-
ction against defendant railroad company to
vent defendant from damming a stream which
ed from defendant's land onto plaintiff's land.
ntiff contended that defendant had entered into
venant with plaintiff in which defendant agreed
to prevent the stream from flowing onto plain-
s land in any way. Defendant acknowledged the
enant but contended that in order for such an
nction to issue, plaintiff had to prove damages
n the damming of the streamflow. While hold-
that a riparian proprietor is entitled to have
er flow onto his land in its natural course un-
inished in quantity and unimpaired in quality,
Court of Appeals of Kentucky found that plain-
had failed to establish such damages as were
essary in order for an injunction to issue based
a convenant not to prevent natural streamflow.
esada-Florida)
1-01048

**UAW ISLAND FREIGHT TERMINAL CO V
ITED STATES (DAMAGES TO ISLAND
OM FAILURE TO MAINTAIN DIKE).**
Ct Cl 269-278 (1939).

criptors: *Dikes, *Flood damage, *United
es, *Storms, Weather patterns, Damages,
ods, Flood protection, Water injury, Legisla-
, Federal government, Administrative agencies,
nds, Project planning, Judicial decisions, Legal
ects.

ntiff island owner sued defendant United States
damages arising from defendant's failure to
ntain a dike to protect plaintiff's island. There
an 8-foot channel along plaintiff's island, and
artificial 3 1/2-foot dike between the channel
the island. Defendant increased the channel
th to 22 feet, but did not strengthen the dike.
ause of increased water flow in the deeper
nnel, several annual storms broke the dike.
ntiff contended that defendant was negligent in
ing to strengthen the dike. Defendant asserted
unprecedented storms were the proximate
se of plaintiff's injury. The court found that the storms were not unusual. Furthermore, the court, noting that it was common knowledge that water pressure increased proportionately with volume and velocity, concluded that defendant should have realized the consequences of its inaction. The court held defendant liable for the injury, giving judgment without interest for plaintiff. (Hart-Florida)
W71-01049

NORFOLK SOUTHERN RR V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR ORDERING REMOVAL OF RAILROAD BRIDGE TO IMPROVE NAVIGATION).
96 Ct Cl 357-377 (1942).

Descriptors: *United States, *Channel improvement, *Bridges, *Condemnation, Condemnation value, Eminent domain, Navigation, Navigable waters, Canals, Railroads, Federal jurisdiction, Legal aspects, Judicial decisions, Federal government, Legislation, Rivers and Harbors Act, Inland waterways, Virginia, Compensation.
Identifiers: Intracoastal waterway.

Plaintiff railroad brought an action against defendant United States to recover damages cuased by plaintiff's replacement of a bridge under defendant's orders so that defendant could deepen and widen a canal to be used in the intracoastal waterway. Plaintiff contended that the order amounted to a taking of property and the governmental immunity had been waived by an act of Congress. Defendant argued that the government had the power to order removal of obstructions to navigation, that the exercise of that power was not a taking of property and that the act of Congress simply conferred jurisdiction on the court to hear the claim but did not create any liability. The court noted that Congress had considered all the facts and all the decisions concerning sovereign immunity. Therefore, for the act to have any meaning at all, it must have been intended to create liability where there ordinarily is none. Consequently, the court held that plaintiff was entitled to a judgment for damages. One judge concurred on the ground that the bridge was not an obstruction to navigation when it was ordered destroyed since only later was the canal widened. Therefore, the order to replace the bridge was a taking of property. (Liptak-Florida)
W71-01050

NORTHWEST RR V UNITED STATES (STRUCTURES ERECTED IN BED OF NAVIGABLE STREAM SUBJECT TO DESTRUCTION WITHOUT REMEDY BY UNITED STATES IN AID OF NAVIGATION.

100 Ct Cl 396-413 (1943).

Descriptors: *Virginia, *Eminent domain, *Navigation, *High water mark, Damages, Compensation, Riparian rights, Leases, Mining, Dams, Flooding, Overflow, Vegetation, Ownership of beds, Legislation, Federal government, Condemnation value, Judicial decisions, Legal aspects, Rivers and Harbors Act, Channel improvement, United States.

Plaintiff corporation constructed a coal tipple in a navigable stream. Subsequently, the level of the river was raised by defendant United States, which caused plaintiff's property to be overflowed and its tipple to be rendered useless. Plaintiff sought damages for injury to its land and reimbursement for the cost of the tipple. Defendant contended that only the value of the overflowed land above the ordinary high water mark was recoverable. The court stated that the high water mark is the line where the water stands sufficiently long to destroy vegetation below it. A riparian owner owns to the low water mark under Virginia law, but title to the bed of the stream up to the ordinary high water mark is subject to a paramount servitude in the United States in the interest of navigation. He who erects a structure in the bed of a navigable stream must do so with the knowledge that the United States can, in the aid of navigation, raise the high water mark so as to destroy or impair the utility of the structure. Consequently, plaintiff was entitled to recover damages for the land overflowed, but not for damage to the tipple. (Price-Florida)
W71-01051

UNITED STATES V APPALACHIAN ELECTRIC POWER CO (FEDERAL GOVERNMENT'S REGULATORY AUTHORITY OVER HYDROELECTRIC PLANT ON A NON-NAVIGABLE, INTERSTATE RIVER).
107 F2d 769-810 (4th Cir 1939).

Descriptors: *Rivers and Harbors Act, *Hydroelectric project licensing, *Non-navigable waters, *Federal jurisdiction, Interstate rivers, Dams, United States, Hydroelectric plants, Federal Power Act, Legislation, Permits, Administrative agencies, Virginia, Navigable rivers, Regulation, Judicial decisions, Legal aspects, Eminent domain, Condemnation, Riparian rights, Navigation, Federal government, Administrative decisions.

Plaintiff United States sued defendant electric power company to enjoin construction of a dam and electric power plant on an interstate river. Defendant had not obtained a license from the Federal Power Commission. Plaintiff contended that the river was navigable and therefore subject to the Rivers and Harbors Act. The act prohibited obstructions to navigation without the consent of Congress or a license from the Power Commission. Defendant argued that the river was not navigable, that Congress' power was limited to control of navigation, and that any controls not connected with navigation were an invalid taking of property. Affirming a judgment for defendant, the court reviewed extensive evidence and concluded that the river's navigability was not established. The Power Commission's authority did not extend to the dam project except to the extent that the dam might possibly affect navigation on other rivers. One justice dissented. (Liptak-Florida)
W71-01052

DIEHM V BOROUGH OF NEW HOLLAND (DAMAGES FOR DIVERSION OF WATER FLOW).
191 A 393-395 (Pa Super 1937).

Descriptors: *Pennsylvania, *Water sources, *Riparian rights, *Diversion, Streams, Spring waters, Water supply, Riparian land, Riparian waters, Alteration of flow, Domestic water, Obstruction to flow, Stock water, Judicial decisions, Reasonable use, Streamflow, Natural flow, Springs, Usufructuary right, Water users, Relative rights.

Plaintiff, a riparian owner, brought an action against defendant, an upper riparian owner, for damages for diverting creek waters from plaintiff's land. Plaintiff contended that defendant piped water away from a spring which supplied the creek and as a result the flow of the creek became so small as to be insuffucient for plaintiff's reasonable domestic and stock purposes. Defendant contended that the taking of the water had not diminished the flow to any appreciable extent in that the spring contributed but a small part to the creek's flow. The court held that there was sufficient evidence to indicate that the flow of the creek had been materially diminished and that such flow was insufficient to meet plaintiff's needs. The court thus held that plaintiff's riparian right to the flow of the stream had been violated and that he was entitled to damages for such violation. (Snow-Florida)
W71-01053

VILLAGE OF WOODBRIDGE V BOGAN (EMINENT DOMAIN AND LIABILITY FOR DAMAGES DUE TO WATER POLLUTION).
291 NYS 381-382 (App Div 1936).

Descriptors: *New York, *Sewage disposal, *Water pollution, *Damages, Boating, Condemna-

tion, Condemnation value, Outlets, Waste disposal, Sewerage, Land, Land appraisal, Land ownership, Lakes, Ponds, Legal aspects, Judicial decisions, Eminent domain, Compensation, Property values, Discharge (Water).

Plaintiff municipality condemned defendants' lands which bordered a lake for the purpose of constructing a sewage plant. Discharge from the proposed plant was to empty into the lake. Defendants were awarded the value of the land condemned and damages for injury to defendants' bathing and boating business which would result from the sewage discharge. Plaintiff appealed such award. The appellate court affirmed per curiam, holding that the evidence supported the award. Two judges would have affirmed but reduced the amount of the award. (Duss-Florida)
W71-01055

SCIENTIFIC HYDROLOGY IN THE WORLD,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 02A.
W71-01072

EASTON V STATE (AMOUNT OF COMPENSATION FOR TAKING OF LAND AND POLLUTING A STREAM).

153 Misc 395, 275 NYS 119-121 (1934).

Descriptors: *New York, *Water pollution, *Subsurface waters, *Compensation, Underground streams, Springs, Watercourses (Legal), Channels, Damages, Flow, Water quality, Water sources, Spring waters, Construction, Grading, Legal aspects, Judicial decisions, Land, Condemnation.

Claimants sought an award for land appropriated for railroad grade elimination purposes and for damages alleged to have been caused when such construction resulted in the pollution of a spring located on county property, the waters of which claimants had reserved to themselves in their instrument of conveyance. The Court of Claims found that claimants were entitled only to the value of the land taken. The spring in question was entirely fed by subterranean waters whose sources and channels were unknown. Liability for interference with such waters can only be sustained upon the theory of negligence. There was no proof that defendant had not done its work in a proper manner. Claimants relied solely on the fact that before construction the spring contained pure water and afterwards the water was unfit. The court held that such was insufficient evidence to prove negligence. (Duss-Florida)
W71-01073

SOUTHERN NEW ENGLAND ICE CO V TOWN OF WEST HARTFORD (CITY LIABLE FOR NUISANCE CAUSED BY DUMPING SEWAGE INTO STREAM).
159 A 470-477 (Conn 1932).

Descriptors: *Connecticut, *Municipal wastes, *Lake ice, *Prescriptive rights, Ice, Water pollution, Ponds, Water pollution effects, Water pollution sources, Sewage, Local governments, Sewage bacteria, Waste identification, Streams, Condemnation, Sewers, Sewage disposal, Flow, Riparian rights, Water rights, Legal aspects, Judicial decisions, Remedies, Damages.

Plaintiff ice dealer sued for damages caused when sewage from defendant city's sewers polluted the pond it cut ice from, thereby forcing its disuse for ice making. Defendant contended plaintiff had no legal right to take the ice. The evidence was clear that the ice was satisfactory until defendant's overflow sewer began dumping raw sewage into a stream that flowed into the pond. The Supreme Court of Errors of Connecticut affirmed a verdict for plaintiff, holding that ice had been harvested from the pond for more than 40 years by plaintiff and its predecessors, and thus plaintiff had a prescriptive right to the flowage of the stream and pond. Defendant had a right to construct sewers, but when such sewers constituted a nuisance, defendant was liable for damages occasioned thereby. (Morris-Florida)
W71-01074

RAU V URBAN (LIABILITY FOR PREDECESSOR'S IN TITLE ACTS).
155 A 498-499 (Conn 1931).

Descriptors: *Connecticut, *Watercourses (Legal), *Obstruction to flow, *Diversion, Overflow, Streams, Land tenure, Natural flow, Relative rights, Beds, Natural streams, Channels, Grading, Legal aspects, Judicial decisions, Damages, Impounded waters.

Plaintiff brought suit against defendants to restrain defendants' obstruction of a natural watercourse which resulted in the overflowing of plaintiff's land. Defendants contended that the alleged obstruction was committed by their predecessors in title, and therefore they could not be held liable. From the trial court's judgment for plaintiff, defendant appealed. The Connecticut Supreme Court of Errors affirmed. The finding that defendants and their predecessors obstructed the flow of the watercourse and caused the overflow was supported by the evidence. Defendants could be properly held liable for their predecessor's acts in obstructing the natural flow of water if defendants were given notice of the obstruction and requested to remove it. (Duss-Florida)
W71-01075

LEITCH V SANITARY DISTRICT (RIPARIAN RIGHTS AND OBSTRUCTIONS TO NAVIGATION).
386 Ill App 433, 54 NE2d 458-462 (1944).

Descriptors: *Illinois, *Navigable waters, *Riparian rights, *Navigation, Transportation, Damages, Nabigable rivers, Watercourses (Legal), Cities, Bridges, Sewers, Conduits, Administrative agencies, Riparian land, Landfills, Construction, Structures, Solid wastes, Wastes, Legal aspects, Judicial decisions, Rivers.
Identifiers: Obstruction to navigation.

Plaintiff riparian owners sought a mandatory injunction against defendant city and its sanitary district to require removal of obstructions from a watercourse. Plaintiffs alleged that their rights of ingress, egress and navigation to a branch of the Chicago River were destroyed by the filling in of such branch, the construction of a sewer and the construction of a permanent bridge. Defendants put in issue paintiffs' ownership of riparian property, the navigability of the branch and its use for transportation. Defendants also denied filling in the branch and alleged that the bridge had been constructed by the State of Illinois. The trial court ruled for defendants and plaintiffs appealed. The Supreme Court of Illinois affirmed. Plaintiffs failed to prove that either defendant constructed the permanent bridge which was the obstruction which cut off navigation from plaintiffs' property except for those boats able to pass under it. The main obstruction by defendants was the sewer which was well below the surface and allowed ample clearance for boats then using the river. Defendants did run a water main along the bridge, but it did not lower the clearance of such bridge. Requiring defendants to remove these structures would have been of no benefit to plaintiffs, and courts will not require performance of a useless act. (Duss-Florida)
W71-01076

OLD DOMINION LAND CO V WARWICK COUNTY (COUNTY HAS LIMITED POWER TO PROHIBIT POLLUTION IN NAVIGABLE RIVER.

200 SE 619-622 (Va 1939).

Descriptors: *Virginia, *Sewage disposal, *Water pollution control, *Navigable rivers, Legal aspects, Judicial decisions, Remedies, Ownership of beds, Navigable waters, Riparian rights, River beds, Local governments, State governments, Regulation, Tidal waters, Tidal effects, Sewers, Septic tanks, Sewage treatment, Water rights, Public rights, Public health, Jurisdiction, State jurisdiction, Sewage.
Identifiers: *Nuisance.

Petitioner land company was convicted of violating county ordinances which prohibited connecting new residences to unapproved sewer systems and emptying untreated sewage into the James River. Petitioner contended that since the acts had not been shown to be a nuisance or injurious to the health of the community, the county had no authority to enact the ordinances. The court stated that only the state legislature has the power to govern sewage emission into tidal waters, unless there is a nuisance or injury to the public health of a community, since such waters are controlled by the state for all the public. Since the James River was navigable, the court held the county ordinances invalid, and reversed the trial court's conviction of petitioners. (Morris-Florida)
W71-01077

O'NEAL V ROLLINSON (RIPARIAN RIGHTS EXTEND PERPENDICULAR TO LAND).

212 NC 83, 192 SE 688-690 (1937).

Descriptors: *North Carolina, *Boundaries (Property), *Riparian land, *Riparian rights, *Riparian waters, Legal aspects, Judicial decisions, Remedies, Ownership of beds, Beds under water, Navigable waters, Banks, Channels, River beds, Docks, Coastal structures, Shores.

Plaintiff riparian owner sought an injunction against a neighboring riparian owner to require removal of a wharf extending onto plaintiff's riparian property. The wharf was built from defendant's land but was T-shaped. The court upheld the lower court's judgment for plaintiff, ruling that riparian rights extend at right angles from the shore line to the edge of the deep water or channel, so that riparian rights lines are parallel to each other. The court noted that if riparian rights were determined by merely extending the angle of property boundaries, some riparian owners' rights would not extend to the deep water line. (Morris-Florida)
W71-01078

FITZSIMMONS V CASSITY (OWNER OF LAND TAKEN BY RIVER RECEIVES TITLE TO OLD RIVER BED).
172 So 824-829 (La Ct App 1937).

Descriptors: *Louisiana, *Boundaries (Property), *Ownership of beds, *Avulsion, Accretion (Legal aspects), *River beds, Legal aspects, Judicial decisions, Remedies, State governments, Local governments, Legislation, Erosion, Navigable waters, Navigable rivers, Surveys, Lumber, Water utilization, Hunting, Game birds, Public rights, Public lands.

Plaintiff sought an injunction to keep defendant from cutting trees and erecting an artificial duck blind on his property. The land in question previously was the bed of a navigable river whose course had changed. This change had resulted in the taking of other property previously owned by plaintiff. Plaintiff contended that under the state civil code ownership of the prior river bed shifted to him to replace this loss of land. Defendant contended that ownership of the bed remained in the sovereign and thus the land was subject to use by the public. The Court of Appeal of Louisiana affirmed the lower court's decision for plaintiff, holding that the civil code applied to give the river bed to the owner of land appropriated by the river. The court stated that the principle is similar to that of eminent domain, except the river acts on its own rather than through government action. (Morris-Florida)

W71-01079

TRANSCONTINENTAL PETROLEUM CORP V TEXAS CO (TITLE TO BEDS OF NAVIGABLE STREAM).
209 La 52, 24 So2d 248-256 (1945).

Descriptors: *Louisiana, *Navigable waters, *Ownership of beds, *Leases, Accretion (Legal aspects), Legal aspects, Judicial decisions, Streams, Navigation, State governments, Vegetation, Streamflow, Streambeds, Silting, Sediments, Silts, Water levels, Water level fluctuations, Geologic investigations, Soil investigation, Watercourses (Legal).

Plaintiff corporations sought to have their mineral lease from the state recognized as including the bottom of a certain watercourse. To do so over the competing claim of defendant corporations, plaintiffs had to show that the watercourse was a navigable stream in 1812 since that was the year Louisiana entered the Union and the state acquired title to the beds of navigable streams by virtue of its sovereignty. If the watercourse was not navigable at that time, the state would not have had title to lease to plaintiffs. The Supreme Court of Louisiana stated that a body of water is navigable when it is rendered available for commerce, whether it is actually so used or not. The court concluded there was not enough evidence to determine whether the stream was or was not navigable in 1812, and thus plaintiffs had failed to carry through the burden of proof needed to support its claim. The trial court's judgment for defendant was affirmed. (Morris-Florida)
W71-01080

FITZGERALD V FORTIER (LIABILITY FOR OBSTRUCTION OF WATERCOURSES).
For primary bibliographic entry see Field 02E.
W71-01082

FOSTER V MALSBURY (INJUNCTIVE RELIEF FOR OBSTRUCTION OF WATERCOURSE).
157 NE 446-448 (Ind Ct App 1927).

Descriptors: *Indiana, *Obstruction to flow, *Watercourses (Legal), *Natural flow doctrine, Dams, Levees, Streams, Beds, Banks, Flow, Channels, Damages, Alteration of flow, Construction, Sands, Gravels, Legal aspects, Judicial decisions, Riparian rights, Natural flow.

Plaintiff sought a mandatory injunction for removal of a dam built by defendants across the bed of a natural watercourse which flowed through defendants' and plaintiff's land. Plaintiff alleged the stream had been the natural watercourse since time immemorial, and defendants' construction would destroy the value of plaintiff's land. Defendants denied the allegations and counterclaimed that the dam in question had been in existence since time immemorial. The lower court found for plaintiff, issued the injunction and assessed nominal damages. The Appellate Court of Indiana affirmed. The findings of fact by the trial court were supported by the evidence. It is well settled that the right to an unobstructed flow of water in its natural channel will be sustained by injunction. Finally, the trial court's decree was specific enough to inform defendants of the exact size and location of the dams which they were being forced to remove. (Duss-Florida)
W71-01083

SCHWARTZ V WAPELLO COUNTY (PUBLIC RIGHTS TO NATURAL DRAINAGE).
227 NW 91-93 (Iowa 1929).

Descriptors: *Iowa, *Surface drainage, *Public rights, *Easements, Natural flow, Natural streams, Surface drainage, Surface water, Administrative agencies, ditches, Culverts, Damages, Legal aspects, Judicial decisions, Watercourses (Legal), Diversion, Discharge (Water), Overlying proprietor, Surface runoff, Remedies.

Plaintiff lower landowner sought to enjoin defendants county and upper landowner from installing a culvert which was designed to drain surface water from defendant upper landowner's property across a highway to a ditch on plaintiff's land. The evidence showed that such installation would reestablish partially the natural drainage of the land. Plaintiff contended, however, that the highway authorities had established a system of drainage which avoided plaintiff's land, that this system had been continued for more than ten years and that therefore it had become a natural watercourse which defendants had no power to change to plaintiff's detriment. The trial court dismissed plaintiff's petition and the Supreme Court of Iowa affirmed. Evidence showed that defendants were attempting to effect better drainage so as to improve the highway's condition. The public's rights were at stake and the statute of limitations could not be urged or claimed against the public. It is Iowa law that an easement exists for the drainage of upper land through lower land by means of natural drainage. (Duss-Florida)
W71-01084

6F. Nonstructural Alternatives

MANAGING THE NATURAL ENVIRONMENT: A REGIONAL PLAN FOR WATER, SEWAGE, AIR AND REFUSE,
Tri-State Transportation Commission, New York.
For primary bibliographic entry see Field 05G.
W71-00829

FLOOD PLAIN INFORMATION, GASTONIA, NORTH CAROLINA.
Corps of Engineers, Charleston, S.C.
For primary bibliographic entry see Field 04A.
W71-00846

FLOOD PLAIN INFORMATION, LITTLE, BOLIN, BOOKER AND MORGAN CREEKS, CHAPEL HILL, NORTH CAROLINA.
Corps of Engineers, Wilmington, N.C.
For primary bibliographic entry see Field 04A.
W71-00847

FLOOD PLAIN INFORMATION, BRUSH CREEK, NORTH HUNTINGDON TOWNSHIP, PENNSYLVANIA.
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
W71-00892

U.S. GEOLOGICAL SURVEY FLOOD-MAPPING PROGRAMS,
Geological Survey, Fairfax, Va.
For primary bibliographic entry see Field 07C.
W71-01056

SPECIAL FLOOD HAZARD INFORMATION REPORT ON SOUTH LEE COUNTY COASTAL AREAS.
Corps of Engineers, Jacksonville, Fla.

Corps of Engineers Special Flood Hazard Information Report, July 1970. 6 p, 8 fig, 9 plate.

Descriptors: *Floods, *Tides, *Flood damage, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Tidal flooding, Flood records, Standard project flood, Intermediate regional flood, Flooded area maps, September 1960 hurricane.

Tidal flooding in Florida along the south shore of Caloosahatchee River from the vicinity of W. P. Franklin Lock near Olga to the mouth of the river, and the offshore keys and low coastal lands south of Punta Rassa and west of U. S. Highway 41 is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of hurricanes, rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-01057

FLOOD PLAIN INFORMATION OF LICKING RIVER, CAMPBELL AND KENTON COUNTIES, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-01095

FLOOD PLAIN INFORMATION STUDY, PIGEON CREEK, VANDERBURGH COUNTY, INDIANA - MAIN REPORT.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W71-01096

6G. Ecologic Impact of Water Development

INITIAL ENVIRONMENTAL STUDY.
Erie and Niagara Counties Regional Planning Board, Grand Island, N.Y.

Available from NTIS as PB-193 321, $3.00 in paper copy, $0.95 in microfiche. June 1970. 85 p. HUD Project NYP-215.
Identifiers: *Urban planning, *New York, Natural resources, Air pollution, Water pollution, Recreation, Industries, Sanitary engineering, Education, *Regional planning and development, *Erie County (NY), *Niagara County (NY).

The report documents the basic environmental data dealing with natural features and man-made activities which have environmental significance. Discusses and maps source of air, water and land pollution and indicates areas most affected. Recommendations include priority problems to be addressed, priority areas to be protected and a scenic corridor concept which would both eliminate some of the problems and include some of the protection areas.
W71-00785

07. RESOURCES DATA

7A. Network Design

ACQUISITION AND MACHINE PROCESSING OF SALINE WATER DATA FROM SOUTHEASTERN NEW MEXICO AND WESTERN TEXAS,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 07C.
W71-00572

OPTIMUM GAGING STATION LOCATION,
Geological Survey, Washington, D C.
For primary bibliographic entry see Field 06A.
W71-00721

A HYDROLOGIC INVENTORY SYSTEM,
State Univ. of New York, Binghamton. Dept. of Geology.
Marie Morisawa.
Water Resources Bulletin, Vol 6, No 5, p 794-801, September-October 1970. 8 p, 4 fig, 4 tab, 11 ref. OWRR Project C-1314.

Descriptors: *Data collections, *Hydrologic data, *Water resources development, Runoff, Discharge (Water), Hydrologic budget, Water quality, Duration curves, Low flow, Peak discharge, Conservation, Water conservation, Ohio, Wyoming.
Identifiers: Water resources inventory, Green River (Wyo), Little Miami River (Ohio).

The decision making process in development of water resources has often been subjective. A scheme for inventorying the hydrologic properties of watersheds would be a powerful tool, providing objective criteria that can be used in judgments and which can be applied in surveys for water management or conservation purposes. Such an inventory was used in studying the Green River, Wyoming and Little Miami, Ohio. The classification system considered characteristics of the water budget, variability and reliability of flow, and water quality. Class ranks for water budget were based on amount of runoff and water loss. Regulation and variation in flow were ranked on impoundments, variability index, coefficient of variability, 90% flow duration, and maximum flow index. Chemical and solid loads were also considered. Classification of the Green and Little Miami Rivers pointed out distinctive differences between their hydrologic characteristics. The inventory can thus be examined to compare stretches of river or whole watersheds, objectively determining the best possible use. (Knapp-USGS)
W71-01097

7B. Data Acquisition

FIELD MEASUREMENT OF SOIL WATER DIFFUSIVITY,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W71-00557

AN AIRBORNE MEASUREMENT OF THE SALINITY VARIATIONS OF THE MISSISSIPPI RIVER OUTFLOW,
Lockheed Electronics Co., Houston, Tex., and National Aeronautics and Space Administration, Houston, Tex.
For primary bibliographic entry see Field 02K.
W71-00562

REMOTE ANALYSIS OF FLUORESCENCE BY A FRAUNHOFER LINE DISCRIMINATOR,
Geological Survey, Washington, D. C.; and Perkin-Elmer Corp., Norwalk, Conn.
For primary bibliographic entry see Field 02K.
W71-00565

MEASURING FLOW THROUGH CREST GATES,
Corps of Engineers, Pittsburgh, Pa.
George E. Terney.
Water Resources Research, Vol 6, No 5, p 1396-1397, October 1970. 2 p.

Descriptors: *Flowmeters, *Discharge measurement, *Stream gages, *Low flow, *Movable dams, Hydraulics, Strain gages, Instrumentation, Measurement, Current meters.
Identifiers: Movable-crest dams.

Equipment was developed for the measurement of flow through crest gates on movable-crest dams. Because of divergency of flow upstream of gate openings, conventional flow measuring devices are not applicable. This system suspends a strain gage and sensor in the flow and measures the resultant forces on the sensor. (Knapp-USGS)
W71-00582

AN IMPROVED METHOD FOR SIZE DISTRIBUTION OF STREAM BED GRAVEL,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W71-00585

A NEW CONDUCTIVITY METHOD FOR DETERMINING CONCENTRATIONS IN PARALLEL PLATE MODELS,
Guelph Univ. (Ontario).
Y. Bachmat, and D. W. Lawson.
Journal of Hydrology, Vol 11, No 2, p 145-158, August 1970. 14 p, 9 fig, 2 tab, 5 ref.

Descriptors: *Hydraulic models, *Groundwater movement, *Instrumentation, *Electrical conductance, Water levels, Solutes, Tracers, Ion transport, Salinity, Flow, Percolation, Velocity, Mixing.
Identifiers: Parallel-plate models.

A new electrical-conductivity method was developed to determine solute concentrations in parallel plate sand models of flow in porous media. The method consists of using two circular electrodes mounted flush in the opposing walls of the model and facing each other on a common normal to the walls. Such an arrangement provides measurements which are averaged across the thickness of the medium and does not modify the local flow pattern or cause local variations in the packing of the porous medium. A method is developed which can be used to determine the volume of the porous medium that is being sampled. The measurements are stable and reproducible for platinum and platinized titanium electrodes and a glass bead medium at concentrations greater than 0.01 N CaC12. Each electrode pair must be calibrated in the model in the presence of the porous medium. (Knapp-USGS)
W71-00593

RIVER DISCHARGE MEASUREMENT BY THE RISING FLOAT TECHNIQUE,
Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
A. J. Dyer.
Journal of Hydrology, Vol 11, No 2, p 201-212, August 1970. 12 p, 6 fig, 1 tab, 2 ref.

Descriptors: *Current meters, *Stream gages, *Discharge measurement, Instrumentation, Calibrations, Stage-discharge relations, Velocity, Currents (Water).
Identifiers: Rising float current-meters.

A comparison is made of rising float and current meter measurements for three rivers having discharges of 250 cusecs, 3,500 cusecs and 10,000 cusecs. The results suggest that an accuracy of a few percent should be readily attained with a properly engineered rising float system. Although less accurate, the technique of using the difference in performance for floats having different terminal velocities could be usefully employed in some circumstances. (Knapp-USGS)
W71-00597

INFORMATION PROCESSING IN WATER RESOURCES RESEARCH,
O'Brien and Gere, Syracuse, N.Y.
M. D. Lagrega, P. Moffa, J. McDonnel, and P. Sze.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 19 p, 7 fig, 1 tab, 9 ref.

Descriptors: *Analytical techniques, *Mathematical studies, *Water resources, *Computer models, Data processing Computer programs, New York, Eutrophication, Management, Monitoring, Sampling, Phosphates, Chemical cnalysis, Biota, Phytoplankton, Engineering, Zooplankton, Fish, Correlation analysis, Temperature, Regression analysis, Dissolved oxygen, Dissolved solids, Diatoms, Statistical methods, Coliforms, Alkalinity, Biochemical oxygen demand, Conductivity, Wind velocity.
Identifiers: Onondaga Lake (NY), Statistical analysis, Limnological investigations.

On the premise that all lakes are unique and require a distinct program of sampling and analysis for their evaluation, the objective of the preliminary investigation was to determine what measurement techniques should be employed. During the detailed phase, emphasis was placed on sampling those locations most representative of the major portion of Onondaga Lake, reflecting changes of a relatively long duration. The computer is essential for evaluating voluminous and complex data accumulated in the limnological investigations. Consideration was given to the form of input data, programming, and filing structure, and data presenta tion--the latter important in conveying representa tion of lake events. Plotted output was the most ef fective. Statistical analysis was useful in clarifyin trends and establishing a base for further investiga tions. Specific programs, such as Mineral Equilibria, were used to determine existing chemi cal relationships. The results of all techniques wer used to arrive at the lake's trophic status upo which engineering considerations for pollutio abatement were based. In response to growin public concern, Onondaga County (New York adopted a comprehensive program to improve con ditions in the watershed and restore the lake as recreational center. (Jones-Wisconsin)
W71-00662

THE DETERMINATION OF THE BIOMASS AND THE NITROGEN CONTENT OF PLANKTON AND ITS PRACTICAL APPLICATION,
Marianne Pavoni.
Verhandlungen der Internationalen Vereinigun fur Theoretische und Angewandte Limnologie, Vo 17, p 987-997, 1969. 5 fig, 1 tab, 14 ref.

Descriptors: *Biomass, *Plankton, *Nitroge *Methodology, Diatoms, Depth, Lakes, Stratifica tion, Water pollution control, Sampling, Rotifers Copepods, Daphnia, Cyanophyta, Bacteria Detritus.
Identifiers: Particulate nitrogen, Dry weight.

Investigations of net sample fractions, cultures o Oscillatoria rubescens and Synedra acus, and sam ples of ulfiltered lakewater gave results in whic ash-free dry weight, particulate nitrogen an biomass are in relatively good agreement. Relation ship between organic weight, particulate nitroge and biomass vary depending on algal species an specific plankton composition. Diatoms possess smaller nitrogen content per organic dry substance Diatom biomass estimated from cell volume i generally too high, as the cell vacuoles are als counted. From unfiltered lakewater the relation ship of biomass to nitrogen within a sample series i generally constant, but may vary greatly from tim to time. The following method in lake investiga tions of nitrogen, especially in routine survey pro grams for determination of the organic substanc formed at the moment, is suggested: determinatio of particulate nitrogen at different depths and ca culation of biomass of one or two mixed samples a least (proportionated according to water colum height between sampling points) according t stratification of the lake, so that an average facto may be attained to assess plankton biomass. Thus picture of lake biological conditions may be ob tained to evaluate problems in water pollution con trol. (Jones-Wisconsin)
W71-00667

PHYSIOLOGICAL-ECOLOGICAL STUDIES O BENTHIC ALGAE IN LABORATORY STREAMS,
Oregon State Univ., Corvallis. Dept. of Botany.
C. David McIntire.
Journal Water Pollution Control Federation, Vo 40, No 11, Part 1, p 1940-1952, 1968. 3 fig, 2 tab 18 ref.

Descriptors: *Physiological ecology, *Benthi flora, *Algae, *Hydraulic models, Laboratory tests Periphyton, Streams, Photosynthesis, Respiration Microorganisms, Light intensity, Carbon dioxide Dissolved oxygen, Temperature, Velocity Cyanophyta, Biomass, Insects, Diatoms Chlorophyta, Chrysophyta, Grazing, Snails, Age Turbidity, Diptera, Mayflies, Detritus.
Identifiers: *Respirometer chamber.

Physiological ecology of benthic algal communitie were studied in laboratory streams. Relativ abundance of algal species depended on seasona fluctuations in chemical and physical properties o the creek water in the experimental streams an combinations of light intensity and curren velocity. Periphyton accumulated on rubble an

gravel growing surfaces most rapidly at relatively high light intensities and current velocities, but was retarded at high densities of grazing snails. Export rate of community material depended on factors influencing biomass accumulation, community age, current velocity and silt load. With communities developed at a light intensity of 550-foot candle, increase in concentration of molecular carbon dioxide markedly increased photosynthetic rate at illumination intensities near and above 1000-foot candle. At light intensities below 500-ft c, a temperature increase of 10C had no significant effect on photosynthetic rate, but at intensities above 1000-ft c, the temperature coefficient varied between 1.3 and 1.6. Community respiration increased exponentially with temperature increases in air-saturated water. Respiratory rates decreased rapidly as dissolved oxygen was reduced below air-saturation. Experiments with laboratory communities suggested that, in certain ecological investigations, the benthic periphyton community may be viewed as a single functional unit or quasi-organism. (Jones-Wisconsin)
W71-00668

THE USE OF THE RADIOCARBON METHOD FOR SUBDIVISION OF PLANKTONIC ANIMALS ACCORDING TO THEIR TROPHIC LEVELS (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii; Akademii nauk SSR, Moscow. Institut Biologii Vnutrennjkh Vod.
E. A. Shushkina, and A. V. Monakov.
Doklady Academy of Sciences of USSR, Vol 184, No 4, p 955-958, 1969. 1 fig, 2 tab, 10 ref.

Descriptors: *Phytoplankton, *Zooplankton, *Laboratory tests, *Trophic level, Radioactivity techniques, Food chain, Daphnia, Chlorella, Scenedesmus.
Identifiers: Predatory species, Bosmina, Polyphemus, Cyclops, Heterocope, Pristicephalus, Eudiaptomus, Mochlonix, Phytophagous.

Two liter volume glass vessels were filled with pond water containing zooplankton and some fine phytoplankton. The vessels received definite amounts of Chlorella and radioactive bicarbonate, and were incubated in the laboratory under natural light and 17-18C for 63 hours. At 12-hour intervals crustacean radioactivity and biomass, different trophic levels were determined by a Geiger counter. The method permitted the subdivision of animals into three fairly well defined trophic levels, the phytophagous crustaceans occupying the first and the larvae of white beam, the third level. Replacement of bicarbonate by labeled culture of Scenedesmus yielded a more pronounced subdivision of animals into three trophic levels represented by phytophagous Pristicephalus shadini, predatory Eudiatomus ambliodon, and facultative predators of Mochlonix spp, respectively. (Wilde-Wisconsin)
W71-00671

ON THE STATISTICAL APPROACH TO ECOLOGICAL STUDIES OF MARINE BACTERIA (IN RUSSIAN),
Gidrometeorologicheskii Institut Odessa (USSR).
For primary bibliographic entry see Field 02L.
W71-00672

TRITIUM - A HYDROLOGIC TOOL,
Geological Survey, Washington, D.C. Water Resources Div.
Gordon L. Stewart.
Annals of Arid Zone, Vol 8, No 2, p 275-281, September 1969. 4 fig, 7 ref.

Descriptors: *Tracers, *Tritium, *Precipitation (Atmospheric), *Radioactivity, *Groundwater movement, Radioactivity techniques, Measurement, Hydrogeology, Clays, Deuterium, Hydrogen, Weather data, Groundwater recharge, Hydrologic data, Radioisotopes, Fallout.
Identifiers: *Tritium pulse.

In selecting a hydrologic tracer, many considerations are involved and cost is one of the most important. Tritium, an isotope of hydrogen, has the advantage of being incorporated into the water molecule, emits low energy beta radiation, has a half-life of 12.26 years and minimizes costs because it is detectable at extremely low concentrations. In general its effects on confining media are negligible although there is some evidence of a high adsorption loss in clay-water systems. Tritium is normally produced at low levels in the atmosphere by cosmic radiation, but since 1952, thermonuclear explosions have universally tagged precipitation with high levels. There is a seasonal peak during the late spring--early summer period and the resulting tritium pulse is extremely useful in hydrogeological work. Mean annual levels decrease yearly and vary with latitude. Modern tritium rainout is of greatest use in areas of rapid recharge where groundwater patterns may be studied. Measuring techniques and general applications are described. (Casey-Arizona)
W71-00690

USE OF SEISMIC REFRACTION MEASUREMENTS FOR GROUND WATER PROSPECTING,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02F.
W71-00860

SOIL WATER MEASUREMENT BY A LOW-RESOLUTION NUCLEAR MAGNETIC RESONANCE TECHNIQUE,
Rothamsted Experimental Station, Harpenden (England).
R. E. Prebble, and J. A. Currie.
Journal of Soil Science, Vol 21, N0 2, p 273-288, September 1970. 16 p, 12 fig, 1 tab, 8 ref.

Descriptors: *Nuclear moisture, Meters, *Soil moisture meters, *Nuclear magnetic resonance, *Calibrations, Analytical techniques, Instrumentation, Soil moisture, Porosity, Clay minerals, Moisture content.
Identifiers: England.

Low-resolution nuclear magnetic resonance analysis was used to measure soil water. The physical principles of the method are outlined. Two sands, five soils, and vermiculite were tested in the laboratory. The instrument readings for all were depressed below the values that might have been expected from absolute water contents. In sands the depression increases with water content, that is, as pores of progressively larger size fill with water. In clay soils an initial depression is attributable to the rigidity with which the first small amounts of water are adsorbed on to the clay lattice: with more water the depression, as in sand, reflects the size distribution of the macropores. 'Relaxation,' a condition needed to ensure accuracy, can be induced by adding iron compounds and salts, but there is evidence that where these substances are present naturally in the soil they may cause different degrees of relaxation from soil to soil. When many soil samples of known type, structural state, and chemical status have to be analyzed, a good calibration curve can be obtained and used to give water contents to a fraction of a percent. (Knapp-USGS)
W71-00870

DIRECT READING FROST GAGE IS RELIABLE, INEXPENSIVE,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Alfred Ray Harris.
Research Note NC-89, Sept 15, 1970. 2 p.

Descriptors: *Frost, *Frozen soils, Wisconsin, Instrumentation.
Identifiers: Frost depth gage.

A tube-type gage is economical, easy to make, and is a reliable indicator of frost depth. Gage readings were within plus or minus 5 centimeters of indicated true frost depth 95 percent of the time. (Harris-Forest Service)
W71-00913

THE USE OF ENVIRONMENTAL SATELLITE DATA FOR MAPPING ANNUAL SNOW-EXTENT DECREASE IN THE WESTERN UNITED STATES,
Allied Research Associates, Inc., Concord, Mass.
For primary bibliographic entry see Field 02C.
W71-00946

TRITIUM IN SURFACE WATER HYDROLOGY-EXPERIMENTAL DETERMINATION OF THE RUNOFF COEFFICIENT (FRENCH),
Bureau of Geological and Mining Research, Orleans (France).
For primary bibliographic entry see Field 02A.
W71-01060

THE GRAVIMETRIC METHOD OF SOIL MOISTURE DETERMINATION, PART I - A STUDY OF EQUIPMENT, AND METHODOLOGICAL PROBLEMS,
South Pacific Regional Coll. of Tropical Agriculture, Alafua (Western Samoa).
For primary bibliographic entry see Field 02G.
W71-01064

THE GRAVIMETRIC METHOD OF SOIL MOISTURE DETERMINATION, PART II - TYPICAL REQUIRED SAMPLE SIZES AND METHODS OF REDUCING VARIABILITY,
South Pacific Regional Coll. of Tropical Agriculture, Alafua (Western Samoa).
For primary bibliographic entry see Field 02G.
W71-01065

THE GRAVIMETRIC METHOD OF SOIL MOISTURE DETERMINATION, PART III - AN EXAMINATION OF FACTORS INFLUENCING SOIL MOISTURE VARIABILITY,
South Pacific Regional College of Tropical Agriculture, Alafua (Western Samoa).
For primary bibliographic entry see Field 02G.
W71-01066

SOME OF ESSA'S CURRENT EFFORTS IN SATELLITE DATA APPLICATIONS FOR HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
Donald R. Baker, and E. Paul McClain.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 108-125, published by Univ of Illinois, 1969. 18 p, 6 fig, 21 ref.

Descriptors: International Hydrological Decade, Conferences, *Research and development, *Satellites (Artificial), *Synoptic analysis, Aerial photography, Surveys, Water resources development, Forecasting, Hydrology, Hydraulics, Data collections, Hydrologic data, Snowpacks, Sea ice, Soil moisture, Planning, Projects, Research facilities, Exploration, Economics, Permafrost, Laboratories, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

There exists an economic and scientific requirement for comprehensive and timely measurement and analysis of hydrologic factors, especially over watersheds where hydrologic survey data are too scant for adequate conservation, management, and prediction of the water resources of the area. Some of the required information can be acquired by remote sensors aboard aircraft or satellites; other data may or only, be obtained from in situ instrumentation, which often can use satellite relay of the data to a forecast or analysis center. Representative

of the more readily obtainable hydrologic information from current satellites (such as ESSA, ATS, and Nimbus) is areal extent of ice and snow cover. ESSA and NASA are examining sensors for obtaining important hydrologic data including the water equivalent of snow, the depth of frozen ground, and the moisture profile in the soil. One promising area of search is in the microwave (active and passive) portion of the electromagnetic spectrum. (See also W71-01067) (Knapp-USGS)
W71-01068

SPACE TECHNOLOGY IN HYDROLOGIC APPLICATIONS,
Geological Survey, Washington, D.C.
Charles J. Robinove.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 88-107, published by Univ of Illinois, 1969. 20 p, 2 tab, 4 ref.

Descriptors: International Hydrological Decade, Conferences, *Research and development, *Remote sensing, *Satellites (Artificial), Water resources development, Forecasting, Hydrology, Hydraulics, Synoptic analysis, Infrared radiation, Aerial photography, Radar, Surveys, Planning, Projects, Research facilities, Exploration, Economics, Laboratories, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

The recent advent of remote-sensing devices provides a capability to collect data economically and repetitively. Space sensing involves the use of passive and active transmitters and receivers of electromagnetic radiation in satellites to collect data on earth features and phenomena. The most familiar sensing device is the photographic camera. Narrow angle lenses (less than 20 deg) provide orthographic terrain pictures when used from orbital altitudes. Such pictures contain little or no distortion due to relief displacement and allow deeper penetration of water than wide angle systems. Infrared-color photography is useful for interpretation of vegetated areas. Multispectral photography is being investigated for its usefulness in hydrology. Infrared sensor data are interpretable in terms of the temperature of water surfaces and the approximate moisture content of the soil and rocks near the surface. Side-looking airborne radar is an excellent tool for all-weather, day or night, coverage of large areas. (See also W71-01067) (Knapp-USGS)
W71-01069

REMOTE SENSING IN SPACE TECHNOLOGY IN HYDROLOGY,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
Paul Bock.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 61-87, published by Univ of Illinois, 1969. 27 p, 22 ref.

Descriptors: International Hydrological Decade, Conferences, *Research and development, *Remote sensing, *Satellites (Artificial), Forecasting, Hydrology, Hydraulics, Surveys, Planning, Projects, Research facilities, Water resources development, Exploration, Economics, Instrumentation, Laboratories, Technology, Computers.
Identifiers: *Water resources research.

Remote sensing with space technology applied to earth observations including hydrology is rapidly developing. An earth observation satellite ERTS-A is being planned and built. Television and multispectral point scanner imagery will be produced in large quantities for studies by hydrologists and other earth scientists. Hydrologists must solve new problems using new approaches. These include the interpretation of the imagery; their areal, repetitive, global nature; their multi-disciplinary implications including national and international questions. Universities must undertake both basic and applied research within a centralized, mission-oriented remote sensing and space technology program. (See also W71-01067) (Knapp-USGS)
W71-01070

RECENT DEVELOPMENTS IN MEASURING TECHNIQUES FOR FLOW IN OPEN CHANNELS,
Geological Survey, Washington, D.C. Water Resources Div.
George F. Smoot, and Harry H. Barnes, Jr.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 194-225, published by Univ of Illinois, 1969. 32 p, 12 fig, 3 tab, 6 ref.

Descriptors: International Hydrological Decade, Conferences, *Reviews, *Stream gages, *Discharge measurement, Open channel flow, Measurement, Stage-discharge relations, Water resources development, Forecasting, Hydrology, Hydraulics, Water measurement, Current meters, Flowmeters, Tracers, Projects, Research facilities, Instrumentation, Tracking techniques, Gaging stations, Laboratories, Technology.
Identifiers: *Water resources research, Stream gaging.

Conventional techniques for measuring the discharge of streams by current meter are standardized and well known. Some sites, however, are not particularly suited to the traditional means of measurement. This paper presents three recent developments resulting from the continuing search by the U. S. Geological Survey for improved methods and new techniques for measuring under such unusual conditions as the extremely unsteady flows in large estuaries, flows at which no stable stage-discharge relationships exist, flows in shallow and turbulent mountain streams, or flows under ice cover. Each of the techniques is discussed with regard to its applicability to these unusual flow conditions. (See also W71-01067) (Knapp-USGS)
W71-01085

PRINCIPLES OF THE APPLICATION OF NUCLEAR TECHNIQUES TO HYDROLOGIC INVESTIGATIONS,
Geological Survey, Denver, Colo.
L. L. Thatcher.
In: The progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 149-193, published by Univ of Illinois, 1969. 45 p, 9 fig, 41 ref.

Descriptors: International Hydrological Decade, Conferences, *Reviews, *Radioactivity techniques, *Tracking techniques, Research and development, Nuclear meters, Stable isotopes, Radioisotopes, Tracers, Water resources development, Forecasting, Hydrology, Hydraulics, Nuclear moisture meters, Soil moisture meters, Projects, Research facilities, Exploration, Instrumentation, Geophysics, Laboratories, Technology.
Identifiers: *Water resources research.

Applications of nuclear techniques have developed in many areas of hydrology but are most important in groundwater. The major applications in the hydrology of groundwater, the unsaturated zone, surface water and water pollution are selectively reviewed with emphasis on applications of more general interest. Groundwater applications are of two types: first, applications that provide information on the regional characterisitics of aquifers, such as average transmissibility over long distances, average residence time and recharge sources; and, second, applications which give local information on individual wells and the aquifer immediately surrounding them. Regional information is provided by investigative techniques based on the 'environmental isotopes.' These are isotopes that are present in the atmosphere and are circulated through the hydrologic cycle in essentially the same way as the water molecule. Local information is provided by the nuclear logging methods and tracer methods based on the artificial injection of tracers. (See also W71-01067) (Knapp-USGS)
W71-01086

NUCLEAR TECHNIQUES IN HYDROLOGY,
International Atomic Energy Agency, Vienna (Austria). Section of Hydrology.
Bryan R. Payne, and Turgut Dincer.
In: The Progress of Hydrology, Vol 1 - New Developments in Hydrology, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 126-148, published by Univ of Illinois, 1969. 23 p, 29 ref.

Descriptors: International Hydrological Decade, Conferences, *Nuclear meters, *Radioactivity techniques, Stable isotopes, Radioisotopes, Water resources development, Hydrology, Hydraulics, Nuclear moisture meters, Soil moisture meters, Tracers, Tracking techniques, Planning, Projects, Research facilities, Exploration, Instrumentation, Geophysics, Borehole geophysics, Laboratories, Technology, Research and development.
Identifiers: *Water resources research.

The application of nuclear techniques in hydrology provides a powerful tool to the hydrologist, not only to solve routine problems, but also new problems for which no solution was known before. The fact that water, even in its vapor state in the atmosphere, can be identified by its isotopic composition and is continuously being labelled on a world-wide scale during the hydrologic cycle, gives to the hydrologist the possibility of solving problems which would have been impossible. At present most environmental isotope laboratories are at universities. This favors hydrologic research dealing with environmental isotopes, provided that the laboratory staff and faculties of engineering and geology have a close cooperation. The establishment of environmental or artificial isotope laboratories in organizations responsible for water resources development should be encouraged and courses on the application of nuclear techniques in hydrology at different levels should be organized to inform the practicing hydrologists of the recent developments in these applications. (See also W71-01067) (Knapp-USGS)
W71-01087

7C. Evaluation, Processing and Publication

WATER RESOURCES INVESTIGATIONS IN THE SUSQUEHANNA RIVER BASIN,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02E.
W71-00564

WATER RESOURCES INVESTIGATIONS IN THE UPPER OHIO RIVER BASIN,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 02E.
W71-00566

QUANTITATIVE MAPPING OF SALINITY, VOLUME, AND YIELD OF SALINE AQUIFERS USING BOREHOLE GEOPHYSICAL LOGS,
Geological Survey, St. Louis, Mo.; and Geological Survey, Austin, Tex.
A. N. Turcan, Jr., and A. G. Winslow.
Water Resources Research, Vol 6, No 5, p 1478-1481, October 1970. 4 p, 2 fig, 4 ref.

Descriptors: *Borehole geophysics, *Saline water, *Transmissivity, *Water yield, Aquifers, Saline water systems, Water resources development, Electrical studies, Resistivity, Porosity, Permeability, Subsurface investigations, Logging (Recording),

Salinity, Surveys, Investigations, Data collections, Hydrologic data, Hydrogeology, Louisiana.
Identifiers: Saline water resources (La).

Techniques that permit a quick, practical, and satisfactory evaluation of electrical logs were developed to estimate the volume and distribution of saline water in aquifers in Louisiana. Of about 200,000 available electrical and induction-electrical logs, approximately 1000 representative logs (about 1 per township) were selected for detailed analysis. An empirical relation, called the field formation resistivity factor was determined as the ratio of formation resistivity to water resistivity corrected to a temperature of 25 deg C. The field formation resistivity factor was used to estimate the altitude of groundwater salinity zones of 1,000, 3,000, and 10,000 milligrams per liter of dissolved solids. Average coefficients of permeability and bed thickness data were used to determine coefficients of transmissibility. Using theoretical and standard conditions of well design, yield, and aquifer thickness, well yields were computed. This permitted an areal comparison of yield from each of the saline water zones. (Knapp-USGS)
W71-00571

ACQUISITION AND MACHINE PROCESSING OF SALINE WATER DATA FROM SOUTHEASTERN NEW MEXICO AND WESTERN TEXAS,
Geological Survey, Albuquerque, N. Mex.
W. L. Hiss.
Water Resources Research, Vol 6, No 5, p 1471-1477, October 1970. 7 p, 7 fig, 10 ref.

Descriptors: *Data collections, *Data processing, *Data storage and retrieval, *Hydrologic data, *Brines, Water quality, Groundwater, Oil industry, Oil fields, Oil wells, Oil reservoirs, Digital computers, Computer programs, Statistics, Saline water.
Identifiers: Permian Basin oil fields (N Mex), Saline water resources.

Approximately 20,000 saline water analyses obtained chiefly from oil companies and related service companies operating in the Delaware basin of southeastern New Mexico and western Texas were indexed to the Permian Basin Well Data System (PBWDS) magnetic tape file, coded, punched into tabulating cards, and stored on magnetic tape for computer operations. Location and operator indexes prepared from the PBWDS file were absolutely essential to efficient machine data processing operations. Extensive manual and computer error checks for duplication and accuracy were made to eliminate data errors resulting from the following: poorly located or identified samples; nonrepresentative or contaminated samples; mistakes in coding, reproducing, or keypunching; laboratory errors; and inconsistent reporting. The original 20,000 analyses considered were reduced to approximately 9000 representative analyses. Costs of acquisition and establishment of the data file approximated $5.00 per usable record. The compiled data were used in a study of the saline water resources of the Permian Artesia group and Capitan and San Andres limestones in southeastern New Mexico and western Texas. (Knapp-USGS)
W71-00572

SYNTHETIC GENERATION OF SEASONAL PRECIPITATION,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 02B.
W71-00600

GROUNDWATER ATLAS OF NEBRASKA (REPRINTED JUNE 1969).
Nebraska Univ., Lincoln. Conservation and Survey Div.

Nebraska University Conservation and Survey Division Atlas, 1969. 7 p, 7 plate, 1 map.

Descriptors: *Groundwater, *Water resources, *Maps, Topography, Observation wells, Irrigation wells, Water quality, Water levels.
Identifiers: *Hydrogolic Atlas, Test holes, Groundwater in storage.

Maps that are pertinent to the groundwater conditions throughout Nebraska are included in the report as follows: Plate 1, Base map of Nebraska; Plate 2, Topographic regions; Plate 3, Groundwater survey test holes, observation wells, and distribution of irrigation wells; Plate 4, Groundwater in storage, Plate 5, Groundwater quality; Plate 6, Contours of water table and depth to static water level; Plate 7, Groundwater regions. (Woodard-USGS)
W71-00613

COMPILATION OF DATA FOR MICHIGAN LAKES,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02H.
W71-00637

CLIMATIC ATLAS OF NORTH AMERICA MEAN SEA AND LAKE SURFACE TEMPERATURES,
Weather Wing (4th), Ent AFB, Colo.
Clarence E. Everson, and Donald T. Brissett.
Available from NTIS as AD-709 887, $3.00 in paper copy, $0.95 in microfiche. June 1970. 46 p. Technical Paper 70-3.
Identifiers: *Meteorological charts, North America, *Atlantic Ocean, Surface temperatures, *Pacific Ocean, Surface temperatures, *Great Lakes, Surface temperatures, Temperature, Sea ice, Climatology.

Monthly charts of mean sea surface temperatures of the Atlantic Ocean from North America to 30 degrees W, Pacific Ocean from North America to 170 degrees E, and the mean lake surface temperature for the Great Lakes are presented.
W71-00784

ON THE COMPUTER EVALUATION OF THIESSEN WEIGHTS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02A.
W71-00864

THE pH OF WATER IN FLORIDA STREAMS AND CANALS,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02K.
W71-00883

LOW-FLOW FREQUENCIES OF ILLINOIS STREAMS,
Geological Survey, Washington, DC.
For primary bibliographic entry see Field 02E.
W71-00884

WATER RESOURCES OF THE CENTRAL NEW YORK REGION,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 02E.
W71-00894

CONSUMPTIVE USE OF IRRIGATION WATER IN WYOMING,
Wyoming Univ., Laramie. Water Resources Research Inst.
For primary bibliographic entry see Field 03F.
W71-00901

AN APPROACH TO THE SELECTION OF A STREAMFLOW BASE PERIOD,
Wyoming Univ., Laramie. Dept. of Civil Engineering.
William Norris Embree.
M.S. Thesis, Wyoming University Graduate School, June 1970. 99 p, 26 fig, 13 tab, 24 ref, 4 append. OWRR Project A-001-WYO (33).

Descriptors: *Streamflow, *Statistics, *Correlation analysis, Synthetic hydrology, Computers, Equations.
Identifiers: Historic data, Base period, Residual mass curves.

Wyoming streamflow records were examined to determine if base periods exist. A base period is a shorter period of record which exhibits the same statistical characteristics as the longer record and can therefore be used in simplifying the study of water resource projects. It was determined that, for twenty-three representative streamflow gaging stations selected, the twenty-year period 1948-1968 provides sufficient information for use as a base period. Maps, tables, and curves pertinent to the study are included. (Woodard-USGS)
W71-00905

U.S. GEOLOGICAL SURVEY FLOOD-MAPPING PROGRAMS,
Geological Survey, Fairfax, Va.
F. Paul Kapinos.
Virginia Polytechnic Institute and State University Water Resources Research Center Bulletin 39, p 75-86, July 1970. 12 p.

Descriptors: *Mapping, *Flood plains, *Surveys, Flood control, Data collections, Floods, Flood protection, Flood plain zoning, Hydrologic data, Surface waters, Frequency analysis, Historic flood, High water mark, Profiles, Hydrographs.
Identifiers: Flood plain mapping.

The principal objective in flood-mapping programs is to provide information that can be used to help reduce and control flood losses. These programs will provide technical information needed for sound economic development of flood plain lands, aid in the improvement of flood-forecasting systems and improve our basic knowledge of floods and flood hazards. The U.S. Geological Survey engages in flood-mapping programs throughout the United States and Puerto Rico. Most programs have been designed to provide data on flood frequency and to prepare Hydrologic Atlases that depict areas inundated by historical floods. Recently, however, particularly in the Federal Programs, the trend has been to prepare flood maps indicating areas inundated by floods of various frequencies. Flood-plain maps of the Hydrologic Atlas Series of the U.S.G.S. describing both historical floods and floods of various recurrence intervals have been prepared in 22 states and Puerto Rico. (Knapp-USGS)
W71-01056

SPECIAL FLOOD HAZARD INFORMATION REPORT ON SOUTH LEE COUNTY COASTAL AREAS.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 06F.
W71-01057

DETERMINISTIC NONLINEAR HYDROLOGIC MODELS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-01081

STATISTICAL SUMMARIES OF MICHIGAN STREAMFLOW DATA,
Geological Survey, Lansing, Mich.
For primary bibliographic entry see Field 02E.
W71-01088

THE ISOLATION OF RANDOM ERRORS IN PERIODIC RAINFALL,
Calgary Univ., Alberta. Dept. of Geography.
Lawrence C. Nkemdirim.
Water Resources Bulletin, Vol 6, No 5, p 767-774, September-October 1970. 8 p, 1 fig, 1 tab, 10 ref.

Descriptors: *Statistical methods, *Rain gages, *Homogeneity, *Variability, Stochastic processes, Rainfall disposition, Sampling, Data collections, Estimating, Hydrologic data, Probability.
Identifiers: Error estimation.

The problem of isolating random errors from rainfall measurements in watersheds of relatively small size is discussed. The residual variance is a practical measure for assessing the error term. (Knapp-USGS)
W71-01100

08. ENGINEERING WORKS

8A. Structures

SPILLWAY DESIGN FLOODS FOR SMALL DAMS IN RURAL MISSOURI,
Missouri Water Resources Research Center, Columbia.
T. E. Harbaugh, and J. E. Thompson.
Available from NTIS as PB-195 284, $3.00 in paper copy, $0.95 in microfiche. Completion Report Missouri Water Resources Research Center, June 1970. 22 p, 2 tab, 12 fig, 4 ref. OWRR - A-025-MO (1).

Descriptors: *Design flood, *Small dams, *Spillways, Statistical methods, Water resources development, Floods, Dam safety, Hydrology, Multiple regression, Missouri.

At present 1970, over 1500 small dams exist within the boundaries of the State of Missouri. Estimates indicate the number is growing at the rate of one hundred to two hundred per year. The main factor in possible failure of these existing dams is an inadequate spillway resulting from poor hydraulic practice and or lack of accurate hydrologic design information. This report presents the result of a state wide analysis of all existing hydrologic data for rural watersheds less than twenty square miles. The results are presented in nomograph form for the 25 and 50 year frequency floods. The report also contains equations for other frequencies at two accuracy levels. The results of this investigation should provide designers of spillways, culverts and bridges with the latest hydrologic flood frequency data for small rural Missouri watersheds.
W71-00626

EARTHQUAKE DESIGN OF COOLING TOWERS,
University of Western Ontario, London. Dept. of Engineering Sciences.
Salman H. Abu-Sitta, and Alan G. Davenport.
Journal of the Structural Division, ASCE, Vol 96, No ST9, Proc Paper 7524, Sept 1970, p 1889-1902. 8 fig, 21 ref.

Descriptors: *Cooling towers, *Dynamics, *Earthquakes, Structural engineering, Vibrations.
Identifiers: *Hyperbolic parabolic shells, Natural frequency, Engineering mechanics, Equivalence factor.

A dynamic statistical approach is used to predict dynamic stresses in a hyperboloidal cooling tower due to earthquake. It is shown that the configuration associated with one circumferential wave is the only one which is excitable by earthquake force and that the first mode of such configuration is dominant. On the basis of this, an equivalent static load is calculated. In the present treatment, boundaries at the base are assumed fixed. This reduced bending moments to negligible proportions. The existence of bending moments and the contribution of modes higher than the first can be easily incorporated in the dynamic treatment. The importance of earthquake design is evident from the comparative values of stresses produced by various loads. For instance in the example given, dead loads produce meridional stress at the fixed base in the order of 270 psi, static wind loads 550 psi, and dynamic earthquake 1140 psi. The data presented give coefficients for equivalent static loads, natural frequencies of cooling towers, and static stresses for seismic load. The information given in the paper provides a simplified analysis to predict dynamic earthquake stresses in cooling towers. (Upadhyaya-Vanderbilt)
W71-00656

STORM DRAINAGE FACILITIES, UNION COUNTY, NEW JERSEY.
Union County Planning Board, N.J.
For primary bibliographic entry see Field 03D.
W71-00827

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
For primary bibliographic entry see Field 05G.
W71-00872

SEWER MONITORING AND REMOTE CONTROL-DETROIT.
Detroit Metro Water Services, Mich.
For primary bibliographic entry see Field 05G.
W71-00876

MINING WATER IN IRAN,
Utah State Univ., Logan. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04B.
W71-00958

STABILITY OF HYPERBOLOIDAL COOLING TOWER,
Uillinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics; and Marley Co., Kansas City, Mo.
Henry L. Langhaar, Arthur P. Boresi, Robert E. Miller, and Jerry J. Bruegging.
Journal of Engineering Mechanics Division, ASCE, Vol 96, No EM5, Proc Paper 7635, p 753-779, Oct 1970. 2 fig, 2 tab, 11 ref.

Descriptors: *Cooling towers, Mathematical model, Winds, Stability.
Identifiers: Fort Martin tower, Buckling, Finite elements, Hyperbolic shells, Linear algebra, Orthotropism, Partition method, Piecewise polynomials.

Theory of instability of an elastic orthotropic shell of revolution subjected to uniform external normal pressure is developed. The theory leads to a linear eigenvalue problem for determination of the buckling pressure. Illustrative numerical calculations based on piecewise-polynomial approximations and the partition method are given for the Fort Martin tower erected in West Virginia. The tower is a reinforced concrete hyperboloidal shell of revolution 370 ft. high and 5.5 in. thick for most of its height. A study of cylindrical shells under wind loading indicates that the present theory is conservative if it is used to estimate dynamic pressure, (1/2) PV2, at which the shell will buckle. Possibly the explanation is that the primary cause of buckling of a cooling tower is the internal vacuum created by wind blowing over the top. Over much of the external surface, the pressure is below that of the atmosphere, and this condition tends to cancel the internal vacuum. (Upadhyaya-Vanderbilt)
W71-00984

8B. Hydraulics

STABILITY OF A SAND BED SUBJECTED TO A SHEAR FLOW OF LOW FROUDE NUMBER,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W71-00560

MODEL TEST RESULTS OF CIRCULAR, SQUARE, AND RECTANGULAR FORMS OF DROP-INLET ENTRANCE TO CLOSED-CONDUIT SPILLWAYS,
Illinois State Water Survey, Urbana.
Harold W. Humphreys, Gunnar Sigurdsson, and H. James Owen.
Illinois Water Survey Report of Investigation 65, 1970. 70 p, 72 fig, 11 tab, 11 ref.

Descriptors: *Spillways, *Drops (Structures), *Vortices, Outlet works, Pipes, Pipe flow, Closed conduit flow, Hydraulics, Spillway crests, Discharge (Water), Flow control, Overflow, Stage-discharge relations.
Identifiers: Closed-circuit spillways.

Hydraulic model studies were performed to develop closed-conduit spillways with single-valued characteristics and to develop criteria for predicting their minimum hydraulic performance when vortex formation at the inlet is not controlled. The model tests included circular, square, and rectangular forms. Although the occurrence of the vortex is unpredictable, a method is presented that can be used to determine when a drop-inlet spillway requires an antivortex device for satisfactory hydraulic performance. Also, a method is presented for determining the minimum performance of a drop-inlet spillway when the vortex-formation is uncontrolled. A horizontal circular plate positioned above the drop-inlet crest of a circular drop-inlet spillway is shown to be an effective antivortex device. Also, a properly positioned plate can significantly reduce the head necessary for the spillway to prime and flow full of water when compared with the priming head at the intersection of the usual weir- and full-flow curves. The plate in this position will also influence the head on the drop inlet and the spillway performance in the normal weir-flow range. For a properly positioned plate large increases in spillway discharge can be obtained for very small increases in the reservoir level. The influence of the antivortex plate on the spillway performance and capacity can be determined from the experimental equation presented. The spillway flow conditions associated with the plate are described. (Knapp-USGS)
W71-00636

METHOD FOR DISCHARGE MEASUREMENTS IN IRRIGATION OUTLETS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
For primary bibliographic entry see Field 03F.
W71-00694

FLOW OF DILUTE POLYMER SOLUTIONS IN ROUGH PIPES,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
Michael Poreh.
April 1970, 25 p. IIHR Report no. 126. NR Task 062-217.
Identifiers: *Polymers, Additives, *Skin friction, Reduction, *Pipes, Surface roughness, Solutions, Mathematical models, Pipe flow, *Drag reducing fluids.

A simplified model is developed to describe the effects of boundary roughness on drag reduction achieved by polymer additives. The model is suitable for both uniform and nonuniform roughness. Predictions of friction coefficients by means of the model are in reasonable agreement with experimental results.
W71-00793

DRAG REDUCTION BY EJECTING ADDITIVE SOLUTIONS INTO A PURE-WATER BOUNDARY LAYER,
Hydronautics, Inc., Laurel, Md.
Jin Wu, and Marshall P. Tulin.
Available from NTIS as AD 709 083, $3.00 in paper copy, $0.95 in microfiche. June 1970. 32 p. Technical Report no. 353-7. Contract Nonr-4181 (00).

Identifiers: *Drag, Reduction, *Boundary layer, Additives, Ejection, Polymers, Viscoelasticity, Water, Flat plate models, *Drag reducing fluids.

Drag reduction caused by ejecting additive solutions from a slot into a pure-water boundary layer on a flat plate was systematically studied. Results include drag measurements for a plane boundary, smooth and rough, with various openings of the slot and with various concentrations and discharges of the ejected additive solution. Conclusions were drawn on the additive requirement in external flows and on the ejection technique for an optimum drag reduction.
W71-00800

DU PONT PLANTS EFFLUENT DISPERSION IN DELAWARE RIVER: HYDRAULIC MODEL INVESTIGATION.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 05G.
W71-00813

CHANNEL IMPROVEMENT, FIRE ISLAND INLET, NEW YORK. HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
William H. Bobb, and Robert A. Boland.
Available from NTIS as AD-709 588, $3.00 in paper copy, $0.95 in microfiche. November 1969. 35 p, plates, figs. Technical Report H-69-16.
Identifiers: *Inland waterways, Hydraulic models, *Beaches, Erosion, Dams, Tides, Stabilization, Ocean currents, Construction, Deflection, Breakwaters, Sand, Atlantic Ocean, New York, *Fire Island Inlet (New York), *Channel stabilization, Littoral drift, Dikes, Beach erosion, Shore protection.

Fire Island Inlet, located on the south shore of Long Island, N.Y., connects the Atlantic Ocean with Great South Bay. The inlet is about 3 miles long and approximately 1/2 mile wide, extending generally east and west between Oak Beach on the north and the western end of Fire Island on the south. Great South Bay, to which Fire Island Inlet is the main entrance, is a tidal body 25 miles long and 2 to 5 miles wide with a general depth of about 6 to 25 ft at mlw. Attempts have been made to stabilize an entrance channel through Fire Island Inlet with little success. To study this problem a fixed-bed model (later converted to a movable-bed model was constructed to scale ratios of 1:500 horizontally and 1:100 vertically, reproducing all of Fire Island Inlet and a portion of the Atlantic Ocean. Tides, tidal currents, and wave action in the Atlantic Ocean were reproduced. Results indicated that the plan originally recommended by the New York District, which included a littoral drift trap located in the entrance to the inlet, a rehandling basin in the inlet, a connecting channel of adequate depth for navigation by a loaded hopper dredge, and a 500-ft extension to the Federal Jetty. The construction of groins, deflection dikes, and closure dikes would not appreciably improve conditions obtained by the recommended plan alone. A plan involving an offshore breakwater and a littoral drift trap located between the breakwater and the beach would also function satisfactorily in every respect.
W71-00822

JET DIFFUSION IN STAGNANT STRATIFIED WATERS,
Royal Inst. of Tech., Stockholm (Sweden).
For primary bibliographic entry see Field 05B.
W71-00835

FLUID MODEL STUDIES OF THE STORAGE OF FRESHWATER IN SALINE AQUIFERS,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 04B.
W71-00838

RUNOFF ROUTING THROUGH STEEP NATURAL CHANNELS,
Research Council of Alberta, Edmonton.
Rolf Kellerhals.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7666, p 2201-2217, November 1970. 17 p, 6 fig, 2 tab, 19 ref, 2 append.

Descriptors: *Routing, *Open channel flow, *Surges, *Unsteady flow, Turbulent flow, Tracers, Bores, Model studies, Hydraulic models, Runoff, Dispersion, Channel morphology, Hydraulics.
Identifiers: Steep channels.

Equations describing steady and unsteady tumbling flow in steep, natural channels are developed and their parameters are evaluated on the basis of field experiments. The hydrologically significant aspects of steady flow can be expressed as a relation between mean storage per unit length and discharge. These functions are evaluated experimentally for 13 test reaches using tracer methods. An exponential form provides consistently good fit to the data. The parameters can be computed from readily available basin data. Nondimensional analysis supports this experimental fact. Unsteady flow data are obtained by observing the passage of small, artificially created surges through the test reaches. Wave propagation appears to be essentially kinematic, but with strong dispersive effects caused by storage in the pool-like channel segments between the frequent critical flow sections. A partial differential equation describing unsteady flow in this type of channel is derived and solved for the initial and boundary conditions of the surge tests. A note on longitudinal dispersion is added. (Knapp-USGS)
W71-00842

GEOMETRIC AND FRICTIONAL EFFECTS OF SUDDEN RELEASES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Shis-Tun Su, and Albert H. Barnes.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7650, p 2185-2200, November 1970. 16 p, 8 fig, 1 tab, 9 ref, 2 append.
NSF Grant GK-1892.

Descriptors: *Waves (Water), *Bores, *Floods, *Unsteady flow, *Surges, Non-uniform flow, Turbulent flow, Open channel flow, Channel morphology, Water level fluctuations, Reservoir operation.
Identifiers: Reservoir releases.

The effects of resistance and channel cross-sectional geometry on waves caused by sudden water release are investigated. The analytical treatment follows Dressler's approach with the modification that channel cross-sectional geometry is included. Results obtained by the analysis include water surface profiles, mean velocity distribution, and trajectory of wave fronts for different Chezy coefficients in rectangular, parabolic and triangular cross-sections. (Knapp-USGS)
W71-00843

AN EQUATION FOR VORTEX MOTION INCLUDING EFFECTS OF BUOYANCY AND SOURCES WITH APPLICATIONS TO TORNADOES,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
For primary bibliographic entry see Field 02B.
W71-00845

REPRODUCIBILITY IN HYDRAULIC MODELS OF PROTOTYPE RIVER MORPHOLOGY,
J. A. Zwamborn.
La Houille Blanche (Grenoble), Vol 21, No 3, p 291-298, 1966. 8 p.

Descriptors: *Channel morphology, *Model studies, *Hydraulic similitude, *River beds, Engineering structures, Roughness (Hydraulic), Scour, Hydraulic models, Prototype tests.
Identifiers: South Africa, Engineering problems.

To solve river engineering problems in South Africa a technique of movable-bed hydraulic models was used. The studies included siting a new bridge, mapping extent of general riverbed scour, determination of local bridge pier scour and river control works. Similarity criteria are given for building the models: Froude's law, conformity of sediment motion, and friction criterion. Geometric distortion of the various models varied from 3.3 to 1.5. Both sand and crushed anthracite were used for bed material. Before completion of the studies a severe flood occurred in one of the river basins and was successfully reproduced in the model; riverbed changes and local scour effects were correctly reproduced to scale. It is concluded that, by using the above similarity criteria, the behavior of models can be expected to yield satisfactory qualitative and quantitative results. (Lang-USGS)
W71-00898

SCALE MODELS SOLVE WATER FLOW PROBLEMS,
F. C. Olds.
Power Engineering, Vol 74, p 40-43, January 1970. 8 fig.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Heat transfer, Thermal stratification, Water temperature, Thermal conductivity, *Model studies.
Identifiers: Heat flow models.

The role of hydraulic models for thermal discharge design is discussed. In the current work load at Alden Research Laboratories, Woruster Polytechnic Institute, there are 20 river and estuary studies for a variety of purposes including thermal discharge. The technique used in this laboratory for thermal discharge modeling is described from the standpoint of efficiency, approximation of prototypes and replacing by other types of models such as computer models. The computer models can fully replace physical muscles. The use of photography techniques for thermal discharge modelings is described. Many of Alden's thermal models cover 20,000 sq. ft. or more. It has been decided that water affected by plant discharges should remain in the model boundaries through two or three tidal cycles. (Novotny-Vanderbilt)
W71-00968

TRANSIENT FLOW BETWEEN PARALLEL DRAINS,
California Univ., Los Angeles; and San Jose State Coll., Calif.
For primary bibliographic entry see Field 04A.
W71-01063

8C. Hydraulic Machinery

UNITED STATES V APPALACHIAN ELECTRIC POWER CO (FEDERAL GOVERNMENT'S REGULATORY AUTHORITY OVER HYDROELECTRIC PLANT ON A NONNAVIGABLE, INTERSTATE RIVER).
For primary bibliographic entry see Field 06E.
W71-01052

8D. Soil Mechanics

EXPERIMENTAL SAND DRAIN STUDY, NAPA RIVER PROJECT, MARE ISLAND,
California State Div. of Highways. Materials and Research Dept.
Travis Smith, W. G. Weber, Jr., Early Shirley, D. R. Howe, and George H. C. Chang.
Available from NTIS as PB-191 357, $3.00 in paper copy, $0.95 in microfiche. Final Report October 1969, 111 p. Research Report 632324.
Identifiers: *Bridges, Soil mechanics, *Sand, Drainage, Hydrology, Soils, Underwater, Compressive properties, Levees, Hydrostatic pressure, Permeability, Statistical data, California.

The results of a special study, involving the use of sand drains to aid the consolidation of weak compressible soils, are presented. Settlements, excess hydrostatic pressures, strength and moisture changes, instrumentation, movements, and failures are discussed. It was found that actual consolidation time lagged behind the theoretical predictions in the sand drain areas. This lag could be predicted by theoretical consideration of the disturbance caused by the displacement method of sand drain installation. High excess hydrostatic pressures, caused by the sand drain installation contributed to failure of the embankment in the sand drain area.
W71-00807

8E. Rock Mechanics and Geology

CRACKING OF EARTH AND ROCKFILL DAMS. A THEORETICAL INVESTIGATION BY MEANS OF THE FINITE ELEMENT METHOD,
Harvard Univ., Cambridge, Mass.
Sergio W. Covarrubias.
Available from NTIS as AD-708 935, $3.00 in paper copy, $0.95 in microfiche. Final report, April 1969. 166 p. Contract Report S-69-5. Contract DACW39-69-C-0029.
Identifiers: *Dams, Foundations, Structures, *Foundations, Cracks, Shear stresses, Rock, Geology, Soil mechanics, Construction materials, Particle size, Elasticity, Revetments, Crack propagation, Mathematical models, Computer programs, Finite element analysis, Computer analysis, *Earth dams, Rockfill dams.

The principal purpose of this study was to investigate by means of the finite element method the effect of the shape of abutments, the effect of compressibility of the foundation, and the effect of zoning of dams on the development of tension cracks in earth and rockfill dams. All materials were assumed to be linearly elastic, with equal properties in tension and in compression. The only load considered was the weight of the embankment, and it was assumed to be applied in a single lift. These assumptions exaggerate the development of tension zones and, therefore, are considered to be justified for the purposes of this investigation. Comparison of the results of finite element analyses of four dams which have cracked, or in which large tension zones have developed, with the observed performance of these dams, has demonstrated good agreement between the theoretical results and the observations. Detailed investigation by means of the finite element method included sixteen longitudinal and fourteen transverse cross sections of idealized dams and the above-mentioned four case records. These analyses showed that by application of the finite element method it is indeed possible to locate zones within dams where tension cracks are likely to develop. The agreement between the observed and computed tension zones and the distribution of longitudinal strains along the crest was found to be reasonably good.
W71-00801

8G. Materials

CONTROLLING DEPOSITS IN COOLING-WATER SYSTEMS,
Nalco Chemical Co., Chicago, Ill.
E. S. Troscinski, and R. G. Watson.
Chem Eng, Vol 77, No 5, p 125-132, Mar 1970. 8 p, 8 fig, 3 tab, 14 ref.

Descriptors: *Cooling water, *Cooling towers, *Scale, Fouling, Costs, *Corrosion, *Calcium compounds, *Magnesium compounds, Iron oxides, Water treatment, Velocity, Heat transfer, Concentration, Dissolved solids, *Heat exchangers, Microorganisms.
Identifiers: *Cooling systems, Scale-forming compounds, Corrosion inhibitors, *Scale prevention, High temperature.

Various deposit-control programs for recirculating water-cooling systems show how such programs prevent premature breakdown of equipment through corrosion and fouling. Initially, deposits form mainly in high-temperature areas such as heat-transfer surfaces and in sections of a system where the velocity of the cooling water is 1 ft/sec or less. Later, there is a tendency for the solids to disperse and redeposit elsewhere in the system. Except for rare instances, such deposits consist of combinations of a wide variety of scales and foulants, rather than of one single type. Mechanisms and types of deposits are discussed. (USBR)
W71-00642

8I. Fisheries Engineering

VETERINARY SUPERVISION FOR FISHERY WATERS,
Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries.
N. Franshtein.
Available from NTIS as PB-192 871T, $3.00 in paper copy, $0.95 in microfiche. Trans. from Veterinariya, Vol. 34. Free translation, February 1970, 2p.
Identifiers: *Fishes, *Diseases, Veterinary medicine, Rivers, Lakes, USSR, *Fisheries.

The organization and carrying out of veterinary measures in fishery waters have been entrusted to the chiefs of the regional stations, in regard to animal disease control; and the accomplishment of necessary diagnostic and hydrochemical investigations - to the directors of the regional veterinary laboratories. All fishery waters (rivers, lakes, reservoirs, ponds) have been assigned to veterinary districts, stations for animal disease control. The veterinary service of the USSR in recent years, carried out veterinary-sanitary rating of pond farms, studied their epizootic condition and accomplished a number of measures for the liquidation of fish diseases.
W71-00823

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

MATHEMATICAL METHODOLOGY IN HYDROLOGY,
Arizona Univ., Tucson. Hydrology and Water Resources.
For primary bibliographic entry see Field 06A.
W71-00722

THE PROGRESS OF HYDROLOGY.
For primary bibliographic entry see Field 06A.
W71-00733

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE ROLE OF MIXING IN STRATIFIED FLOWS - AN ANNOTATED BIBLIOGRAPHY,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02E.
W71-00650

A SYSTEM OF INFORMATION CENTERS FOR RESEARCH AND DECISION MAKING,
Urban Inst., Washington, D.C.
Charles C. Holt.
American Economic Review Vol LX, No 2, p 149-165, May 1970.

Descriptors: *Decision making, *Data collection, Government, Research and development, *Cost, *Computers, Programs, Economic efficiency, Planning, Forecasting, Economies of scale.
Identifiers: *Economic research, *Privacy, Communications, Public administration, Information centers, Library services.

The paper explores the area of data and computer utilization in the context of research and public policy decision making. The author is interested in seeing where data and computer utilization relate to policy decisions. Thus, the interconnections are traced between basic research, problem-oriented research, program planning, decision making and government operations. A number of problems are pointed out including: the inadequacy of applied and programmatic research, communication break-downs between the research and decision levels and low quality programming. The author recommends that new institutions and programs in applied and programmatic research should be developed, along with a national system of flexible, decentralized, but intercommunicating information centers. The analysis stresses the strong interrelatedness of research, decisions, data, computing, library services and different disciplines, institutions and problems. Effective policy decision making in the water resource area requires full utilization of existing economic data. This article, therefore, is relevant to efforts aimed at improving the efficiency of the decision making procedures which exist in the water resource planning process. (Murphy-Rutgers)
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National Bureau of Standards, Washington, D.C., Analytical Chemistry Div.

Available from the NTIS as PB 192 877, $3.00 in paper copy, $0.95 in microfiche. June 1970, various paging. NBS Technical Note 534.
Identifiers: *Oceanology, *Radioactivation analysis, *Bibliographies, Radioactivation analysis, Sea water, Fishes, Shellfish, Algae, Seaweed, Trace elements, *Neutron activation analysis.

The literature of oceanography in activation analysis is reindexed in detail with respect to Element Determined, Matrix Analyzed and Technique Used for precise literature searching. An author index is included. Candidates for inclusion in this bibliography were extracted from Matrix Analyzed categories of fish, shellfish, seaweed marine sediments and seawater.
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National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

Available from the NTIS as PB 192 876, $3.00 in paper copy, $0.95 in microfiche. June 1970, various pagings. NBS Technical note 532.
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Geological Survey, Denver, Colo. Water Resources Div.

Geological Survey Open-file Report, April 1970. 2 p.

Descriptors: *Bibliographies, *Publications, *Colorado, *Water resources, *Hydrogeology, Data collections, Hydrologic data, Groundwater, Surface waters, Water supply.
Identifiers: Water resources bibliography (Colo).

Water resources and hydrogeologic publications pertaining to Colorado up to 1970 are listed in a bibliography which also discusses where the publications may be obtained or consulted. Their prices are also listed if applicable. (Knapp-USGS)
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 3
FEBRUARY 1, 1971

W71-01101 -- W71-01650

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 3
FEBRUARY 1, 1971

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1954, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

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07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

THE DIELECTRIC RELAXATION SPECTRA OF WATER, ICE, AND AQUEOUS SOLUTIONS AND THEIR INTERPRETATION. VIII. TRANSFER OF PROTONS THROUGH 'PURE' ICE I (h) SINGLE CRYSTALS. I. POLARIZATION AND CONDUCTION. III. EXTRINSIC- VERSUS INTRINSIC POLARIZATION: SURFACE VERSUS VOLUME CONDUCTION,
Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
Author R. von Hippel, Dieter B. Knoll, Modesto A. Maidique, and W. B. Westphal.
Available from NTIS as AD-702 073, $3.00 in paper copy, $0.95 in microfiche. See also AD-689 179. February 1970. Various pagings. Technical Report 8.Contract No. N00014-67-A-0204-0003.
Identifiers: *Ice, Dielectric properties, Single crystals, Crystal growth, Carriers, Semiconductors, Electrical conductance, Adsorption, Spectrum, Polarization, Crystal lattice defects, Doping, Dielectric spectroscopy, Transconductance.

The report consists of three scientific papers, the outcome of three years of experimental work on ice (h) single crystals and its theoretical interpretation. In the first paper a short description is given of crystal growing and sample handling techniques and of equipment covering the range (10 to the th) to (8 x 10 to the -3rd) Hz, OC to -180C. Rigorous control of error limits and an improved computerized evaluation procedure alloys to resolve the dielectric spectrum of ice into four significant components with very characteristic trends. The interpretaton of these data requires new models developed in the second paper. The third paper supplements the a-c polarization studies by d-c and transient measurements ranging from 0.01 to 40000 V/cm, from nanoamperes to microamp, and from 100 microsconds to 3 hrs. It appears that an ideal ice crystal seems really to have no ionic charge carrier transport through its volume but a very strong one along its surfaces. Instead of a saturation current we find a small extrinsic saturation charge, extractable in high fields and giving no evidence of a special proton transfer mechanism across hydrogen bridges. Aged single crystal samples show six clearly separated relaxation spectra. Many contradictory statements in the literature about activation energies of conduction, etc., become clarified experimentally and understood.
W71-01127

SEDIMENTATION AND FREE HYDROGEN (IN RUSSIAN),
A. I. Molchanov.
Doklady Academii nauk SSSR, Vol 182, No. 2, p 445-448, 1968. 1 tab, 9 ref

Descriptors: *Sediments, *Hydrogen, *Organic matter, Mineralogy, Iron, Sulfur, Oxidation, Oil, Natural gas.
Identifiers: Hydrocarbons.

A previous study demonstrated that iron of finely ground minerals is oxidized in water with a release of free hydrogen. The latter is capable, in combination with organic matter, to form hydrocarbons. Similar tranformations take place under the influence of finely dispersed matter containing sulfur. Because a large part of clay shales, slates, and argilites is enriched in organic matter, a hypothesis is advanced that such sedimentary rocks may serve as source of hydrogen effecting the formation of oil, natural gas, and other hydrocarbons. (Wilde-Wisconsin)
W71-01472

02. WATER CYCLE

2A. General

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01194

LIST OF INTERNATIONAL HYDROLOGICAL DECADE STATIONS OF THE WORLD.

UNESCO Studies and Reports in Hydrology No 6, Paris, France, 1969, 148 p.

Descriptors: *International Hydrological Decade, *Data collections, *Stations, Networks, Surface waters, Lakes, Groundwater, Evaporation, Soil moisture, Hydrology.

The list includes the names and principal characteristics of all stations selected by the National Committees of countries participating in the Decade to carry out observations on the following hydrological elements: water discharge of rivers, observations on lakes, evaporation from the water surface, evaporation from the soil, groundwater regime. For greater convenience in finding a particular station, information on Decade Stations is presented in five tables: I. River stations; II. Lake stations; III. Pan-evaporation stations; IV. Lysimeter stations; V. Groundwater stations. In each of these tables information is given by continent and within each continent countries are listed in English alphabetical order. The names of the stations are given in one of the four working languages of Unesco, as listed by the country preparing the information; the Russian station names have been transliterated. (Woodard-USGS)
W71-01208

EVALUATION OF SIMULATION MODELS FOR RIVER RUNOFF THROUGH NYQUIST PLOTS,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-01218

SIMULATION OF A RIVER THERMAL BEHAVIOR FROM DATA OBTAINED BY A CLASSICAL METEOROLOGICAL NETWORK (FRENCH),
Electricite de France, Chatou.
R. Gras.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 491-502, 1969. 12 p, 4 fig, append.

Descriptors: *Heat budget, *Rivers, *Water temperature, Heat balance, Meteorological data, Evaporation.
Identifiers: France.

The temperature of a river may be computed by the heat budget method using data given by a meteorological network. This temperature is generated without knowing the upstream temperatures; the heat budget method allows study of the temperature evolution along a river stretch with artificial perturbations. Two applications are discussed, one on the Moselle River, France, near Blenod and the other on the Marne River where the natural temperature upstream from Vaires power plant and the river cooling downstream are computed. (Knapp-USGS)
W71-01221

AN ANALYSIS OF RUNOFF MODELS,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
Fusetsu Takagi.
French resume included. In: Proceedings 13th Congress of the Internation Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 145-155, 1969. 11 p, 9 fig, 1 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Hydrograph analysis, Subsurface runoff, Confined water, Percolating water, Parametric hydrology, Model studies, Runoff forecasting, Streamflow forecasting, Surface-groundwater relationships.
Identifiers: Kinematic wave theory.

An analytical study of runoff models is based on the kinematic view of groundwater runoff. Groundwater runoff may be characterized by the two components, one due to confined aquifers and the other to unconfined aquifers. Equations are derived for the variation of these components, and the physical significance of the parameters in the equation is discussed. Comparisons are made between the estimated and the observed hydrographs for an existing river; their correlations are good. (Knapp-USGS)
W71-01232

A STOCHASTIC MODEL TO SIMULATE MONTHLY RIVER FLOW SEQUENCES,
Osaka Univ. (Japan). Hydraulics Lab.
For primary bibliographic entry see Field 04A.
W71-01233

A NEW RATIONAL METHOD FOR CALCULATION OF MAXIMUM FLOOD DISCHARGE BY AMOUNT OF RAINFALL IN THE CATCHMENT,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01234

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF,
Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
Donn G. DeCoursey, and Edward H. Seely.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 123-131, 1969. 9 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Synthetic hydrology, *Simulation analysis, *Mathematical models, *Stochastic processes, *Statistical models, Rainfall-runoff relationships, Regime, Lane use, Soil moisture, Evapotranspiration, Water balance, Hydrologic budget, Streamflow forecasting, Runoff forecasting.
Identifiers: Synthetic runoff series.

Synthetic sequences of daily storm runoff were generated for an 1,110-acre watershed in Texas, using both deterministic and stochastic elements. The watershed model, a function of land use, soil moisture, and evaporation, is deterministic in that a functional relation exists between the inputs and the model response. However, a probabilistic element was fitted to the unexplained variance of the watershed response. Inputs to the system are stochastic and consist of daily rainfall and evaporation. A two-state Markov chain of transition probabilities is used to calculate the occurrence or nonoccurrence of rainfall. The amount of rainfall is uncorrelated with previous rainfall or length of dry period. Monthly evaporation is correlated with the previous month's evaporation and present month's rainfall. (Knapp-USGS)
W71-01235

ANALOG COMPUTERS FOR FOREST HYDROLOGY RESEARCH,
Washington Univ., Seattle. Inst. of Forest Products.
For primary bibliographic entry see Field 07C.
W71-01411

EFFECTS OF FOREST CUTTING AND HERBICIDE TREATMENT ON NUTRIENT BUDGETS IN THE HUBBARD BROOK WATERSHED-ECOSYSTEM,
Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences; Yale Univ., New Haven, Conn. School of Forestry; Geological Survey, Washington, D.C.; and Forest Service, (USDA), Durham, N.H. Northeastern Forest Experiment Station.
Gene E. Likens, F. Herbert Bormann, Noye M. Johnson, D. W. Fisher, and Robert S. Pierce.
Ecological Monographs, Vol 40, No 1, p 23-47, 1970. 15 fig, 8 tab, 54 ref.

Descriptors: *Forests, *Cutting management, *Herbicides, *Nutrients, *Ecosystems, *Watersheds (Basins), Streamflow, Ions, Nitrates, Sulfates, Drainage water, Dissolved solids, Nitrogen cycle, Hydrogen ion concentration, Temperature, Electrical conductance, Dissolved oxygen, Air pollution, Chemical analysis, Eutrophication, Transpiration, Precipitation (Atmospheric), Runoff, Evaporation, Geologic formations, Dusts, Turbidity, Erosion, Conductivity, Chlorides, Silica, Ammonia, Microorganisms, Algae, Calcium, Magnesium, Potassium, Sodium, Aluminum, Bicarbonates, Nitrification, Seasonal.
Identifiers: *Hubbard Brook Experimental Forest, Particulate matter, Nitrosomonas, Nitrobacter, Thiobacillus thiooxidans, Desulfovibrio, Ulothriz zonata.

Quantity and quality of drainage waters were significantly altered following deforestation of a northern hardwoods watershed-ecosystem. Annual water runoff exceeded expected value (based on undisturbed watershed) by 39% during first water-year after deforestation and 28% during the second. Deforestation resulted in large increases in concentrations of all major ions except ammonium, sulfate, and carbonic acid, with greatest increase for nitrate in streamwater. Sulfate was the only major ion that decreased after deforestation. In undisturbed watersheds, streamwater has a pH of about 5.1 from sulfuric acid, whereas after deforestation it became a nitric acid solution of pH 4.3 enriched in metallic ions and dissolved silica. The increase in nitrate concentration in precipitation may somewhat increase air pollution. Greatly increased export of dissolved nutrients from the deforested ecosystem was due to an alteration of the ecosystem nitrogen cycle. Increased availability of nitrate and hydrogen ions resulted from nitrification. Total new export of dissolved inorganic substances was 14-15 times greater than from natural ecosystems. The deforestation experiment resulted in significant pollution of the drainage stream, with nitrate concentration exceeding the maximum recommended for drinking water. A bloom of algae appeared each summer. (Jones-Wisconsin)
W71-01489

ALGORITHMS FOR PSYCHROMETRIC CALCULATIONS (SKELETON TABLES FOR THE THERMODYNAMIC PROPERTIES OF MOIST AIR),
National Bureau of Standards, Washington, D.C. Building Research Div.
T. Kusuda.
Available from NTIS as PB-189 459, $0.95 in microfiche. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price $0.55. Building Sciences Series 21, January 1970. 50 p.
Identifiers: *Humidity, Thermodynamics, *Air, Altitude, Hygrometers, Moisture, Tables, *Psychrometric charts.

Computer algorithms to obtain thermodynamic properties of saturated and unsaturated moist air are presented in the paper. Sample calculations were performed using a computer program based upon the algorithms presented herein and the results are attached.
W71-01529

VARIATION OF URBAN RUNOFF WITH DURATION AND INTENSITY OF STORMS,
Texas Tech Univ., Lubbock. Water Resources Center.
For primary bibliographic entry see Field 05B.
W71-01546

2B. Precipitation

EFFECTS OF SIMULATED CLOUD SEEDING ON STREAMFLOW OF SELECTED WATERSHEDS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 03B.
W71-01116

CLOUD SEEDING EXPERIMENT - TASMANIA, 1965 - 1966 ANNUAL REPORT,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
For primary bibliographic entry see Field 03B.
W71-01129

RAINFALL DEFICIENCIES OF THE PLATEAU OF TANZANIA,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
William C. Kuepper, III.
Available from NTIS as AD-703 233, $3.00 in paper copy, $0.95 in microfiche. PhD Thesis, Univ. of Wisconsin, July 1968. 220 p. Contract N00014-67-A-0244-0001.
Identifiers: *Rainfall, Subsaharan Africa, Atmospheric motion, Diurnal variations, Intensity, Atmosphere models, Moisture, Humidity, Atmospheric temperature, Plants (Botany), Terrain, Haze, Cumulus clouds, Storms, Tropical regions, Tanzania, Westerlies, *Rainfall deficiencies, Monsoons.

The report contains a descriptive-explanatory climatology that concentrates on those aspects of climatic controls which make the Plateau of Tanzania unusually dry. Synoptic models are used to help explain climatology and rainfall patterns in East Africa. The main portion of the study is a season by season examination of: one, the rainfall patterns of this unusually dry area, and two, the unique aspects of the climatic and synoptic features of the atmosphere which create the seasonal and regional rainfall patterns.
W71-01151

SOME PROBLEMS CONCERNING THE TECHNIQUE OF SEEDING SUPERCOOLED STRATUS CLOUDS FOR THE PURPOSE OF SCATTERING THEM,
Foreign Technology Div., Wright-Patterson AFB, Ohio.
For primary bibliographic entry see Field 03B.
W71-01164

THE DETERMINATION OF SUITABLE AVERAGE VALUES OF METEOROLOGICAL DATA FOR USE IN ESTIMATION OF EVAPOTRANSPIRATION,
North Dakota Water Resources Research Inst., Fargo.
For primary bibliographic entry see Field 02D.
W71-01190

SIMULATION OF A RIVER THERMAL BEHAVIOR FROM DATA OBTAINED BY A CLASSICAL METEOROLOGICAL NETWORK (FRENCH),
Electricite de France, Chatou.
For primary bibliographic entry see Field 02A.
W71-01221

MICROMETEOROLOGY AND ENERGY EXCHANGE IN TWO DESERT ARTHROPODS,
Arizona State Univ., Tempe. Dept. of Zoology.
For primary bibliographic entry see Field 02I.
W71-01294

THE UNPRECEDENTED RAINS IN VIRGINIA ASSOCIATED WITH THE REMNANTS OF HURRICANE CAMILLE,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
Francis K. Schwarz.
Monthly Weather Review, Vol 98, No 11, p 851-859, November 1970. 9 p, 20 fig, 1 tab, 8 ref.

Descriptors: *Hurricanes, *Rainfall, *Synoptic analysis, *Probable maximum precipitation, *Virginia, Weather, Precipitation (Atmospheric), Floods, Disasters, Data collections, Isohyets, Meteorology, Rainfall disposition, Weather data.
Identifiers: Hurricane Camille (1969).

The rainfall and synoptic features of the unprecedented Virginia storm associated with the remnants of hurricane Camille were analyzed. The rains of this storm are within 80 to 85 percent of the probable maximum precipitation for a duration of 12 h for areas up to 1,000 sq mi. Persistent low-level moisture feeding into the remains of Camille's cyclonic circulation was close to the maximum persisting value for the season and location. The passage of the remnant low-pressure system a little to the south of the rain area resulted in low-level flow from the southeast which utilized the moisture, with some orographic intensification without depletion by upwind barriers. In addition to the very high moisture values, a number of synoptic and mesoscale weather factors operated together to produce the remarkable rainfall. (Knapp-USGS)
W71-01326

ARCTIC ICE AND SEA TEMPERATURE ANOMALIES IN THE NORTHEASTERN NORTH ATLANTIC AND THEIR SIGNIFICANCE FOR SEASONAL FORESHADOWING LOCALLY AND TO THE EASTWARD,
Ocean-Atmosphere Research Inst., Cambridge, Mass.
For primary bibliographic entry see Field 02C.
W71-01332

ENVIRONMENTAL CHANGES AND THE ORIGIN OF AGRICULTURE IN THE NEAR EAST,
Minnesota Univ., Minneapolis. Dept. of Geology.
H. E. Wright, Jr.
From a symposium 'Pleistocene Man-Environmental Relationships', held at VIIth Congress of the International Association for Quaternary Research (INQUA), Boulder, Colorado, 1965. BioScience Vol 20, No 4, p 210-212, 217, 15 February 1970. fig, 10 ref.

Descriptors: *Pleistocene epoch, *Environmental effects, *Paleclimatology, *Agriculture, *Palynology, Temperature, Arid lands, Rainfall, Climatic data, On-site investigations, Domestic animals, Grains (Crops), Oak trees, History, Seeds, Ecosystems, Habitats, Ecology, Geologic time, Pollen, Dating.
Identifiers: *Near East, *Agricultural origin, *Cultural origins, *Paleoecology, Life zones, Archaeology.

The 'oasis theory' of agricultural origins in the Near East postulates increasingly arid conditions at the end of the Pleistocene which forced man and animal together at scattered waterholes and

resulted in domestication. The theory is unsupported by detailed paleoecological studies or absolute dating measurements. Archaeological evidence from the Tautros-Zagros Mountain arc indicates a cultural sequence starting about 11,000 years ago when the inhabitants of the area were cave-dwelling hunters and gatherers. About 2,000 years later, they lived in permanent villages, cultivated grains and raised domestic animals. Pollen and seed diagrams furnish some evidence of a gradual warming of the area during that period, followed by reinvasion of oaks and seed grains (wild barley and emmer) from their Pleistocene refuges. The humans may have gradually realized the importance of the grains, leading to the development of agriculture. Detailed knowledge of rainfall and temperature changes in this period are lacking. (Casey-Arizona)
W71-01403

CONCERNING THE STRUCTURE OF PRECIPITATIONS. III. RAIN IN THE ARCTIC, TEMPERATE, AND TROPICAL ZONES,
Sandia Corp., Albuquerque, N. Mex.
M. Diem.
Trans. from Arch. Meteorol. Geophys. Bioklimatol., Vol 16, 1968. Available from NTIS as SC-T-70-4006, $3.00 in paper copy, $0.95 in microfiche. Sandia Laboratories Translation, February 1970. 45 p, 21 ref.
Identifiers: *Rain, Raindrops, Intensity, Particle size, Radar reflections, Arctic regions, Tropical regions, Austria, Translations.

The structure of precipitation, which has been measured at eight stations distributed from the polar to the tropic zone, is mainly determined by the atmospheric stratification and by the geographical situation. Characteristic variations could be found at the different stations, which show up in the number of drops within the various classes of drop sizes or in the range of the spectrum. Rains caused by barrage or by lability are distinctly different. For Karlsruhe one can derive seasonal variations from the data collected in two years. Intense rains are combined with lability and high temperature and, therefore, are absent in the polar zone. Besides this, they appear only with broad spectra and are bound to large numbers of drops usually in the tropics. Between an ideal railfall and a usually measured one there are always differences on account of the drops of different sizes which always appear (spectrum). From the observed structure of a rain one can derive its radar-reflectivity. Owing to the range of the spectrum it deviates largely from the reflectivity of the ideal rain, too, and differs from station to station. All this does not depend on whether one selects the mean drop diameter, the range of the spectrum, the water contents or the intensity of the rain as a parameter. Generally, the intensity of the observed rain is up to five times smaller than the intensity of the corresponding ideal rain. Finally, the durational progress of the single rains presents examples of the increase of the variation of all parameters with increasing intensity of the rain, and of the difficulty to predict correctly the intensity of the expected precipitation from radar observations.
W71-01521

ATMOSPHERIC MODELING, FIELD PROGRAMS, AND DECISION SYSTEMS,
Rand Corp., Santa Monica, Calif.
R. W. Murray.
Available from NTIS as AD-702 672, $3.00 in paper copy, $0.95 in microfiche.Rept No P-4315, March 1970. 15 p, 3 fig, 9 ref.
Identifiers: *Artificial precipitation, *Atmosphere models, Atmospheric motion, Hydrodynamics, Clouds, Convection (Atmospheric), Mathematical models, Weather modification.

The interrelation between field programs and atmospheric modeling is discussed in the context of studies of weather modification. In particular, numerical models of convective clouds are considered. It is shown how activities in both field programs and modeling affect decisions concerning each other, culminating in the use of models for day-to-day 'go ' and 'no go' decisions concerning the field programs. This talk was prepared for the Sixth Skywater Conference, sponsored by the Bureau of Reclamation in Denver, 10-11 February 1970.
W71-01535

2C. Snow, Ice, and Frost

DEEP CORE STUDIES OF THE CRYSTAL STRUCTURE AND FABRICS OF ANTARCTIC GLACIER ICE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Anthony J. Gow.
Available from NTIS as AD-704 348, $3.00 in paper copy, $0.95 in microfiche. February 1970. 20 p. Research Report 282.
Identifiers: *Crystal structure, Ice, *Ice, Antarctic regions, Glaciers, Sampling, Drilling, Crystal growth, Deformation, Structural properties, Melting, Thickness, Drill core analysis, Byrd Station (Antarctica), Little America 5 (Antarctica), Ross Ice Shelf, Ice fabrics.

Radical differences in the crystal structure and fabrics of glacier ice cores at Byrd Station and Little America V, Antarctica, are attributed to gross differences in the thermal and deformational histories of the ice at these two locations. At Byrd Station the mean size of crystals increased more than sixfold between 65 meters and the bottom of the drill hole at 309 meters. Crystal size was also found to increase linearly with the age of the ice, thus simulating isothermal grain growth in metals. However, this growth was not accompanied by any dimensional orientation of crystals or entrapped bubbles, or by any significant increase in the degree of preferred orientation of crystallographic c-axes. These observations imply that negligible shearing is occurring in the top 300 meters of the thick grounded ice sheet at Byrd Station. By contrast very considerable deformation is indicated for the floating 258-m-thick Ross Ice Shelf at Little America. This deformation is characterized by the widespread occurrence of 'strained' crystals below 65 meters, the existence of elongated orineted bubbles between 95 meters and 130 meters and the attainment of pronounced crystal orientation (multiple-maxima fabrics) by 100-meters depth. Exaggerated growth of crystals below 150 meters is attributed to increasing temperatures in the ice shelf. The crystal structure of these cores clearly demonstrates that glacial ice only is present in the Ross Ice Shelf at Little America V.
W71-01159

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART I. FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 04A.
W71-01176

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART II. TRANSLATIONS OF SELECTED TOPICS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 04A.
W71-01177

ARCTIC ICE AND SEA TEMPERATURE ANOMALIES IN THE NORTHEASTERN NORTH ATLANTIC AND THEIR SIGNIFICANCE FOR SEASONAL FORESHADOWING LOCALLY AND TO THE EASTWARD,
Ocean-Atmosphere Research Inst., Cambridge, Mass.
I. I. Schell.
Monthly Weather Review, Vol 98, No 11, p 833-850, November 1970. 18 p, 37 fig, 5 tab, 46 ref. NSF Grant GA-1264.

Descriptors: *Water temperature, *Sea ice, *Arctic, *Weather forecasting, Precipitation (Atmospheric), Synoptic analysis, Weather patterns, Atlantic Ocean, Meteorology.
Identifiers: Arctic ice limit.

A 6-yr period with an extreme northerly ice limit and relatively high sea temperatures in the North Atlantic and another 6-yr with an extreme southerly ice limit and relatively low sea temperatures during April-September were compared to find the effects of sea temperature anomalies on the contemporary and subsequent October-March air temperatures and precipitation locally and to the eastward. A relationship was found with the contemporary and the subsequent cold season temperature and precipitation progressively later in Iceland, Europe, the Middle East, northern Pakistan, and India, in keeping with the general movement of weather systems from west to east in the middle and high latitudes. A basis for estimating the cold season temperature and precipitation in the northeastern North Atlantic, Europe, the Middle East, northern Pakistan, and India may become available early in October. (Knapp-USGS)
W71-01332

ELECTRICAL PROPERTIES OF SALINE ICE,
McGill Univ., Montreal (Quebec). Dept. of Physics.
J. R. Addison.
Available from NTIS as AD-704 269, $3.00 in paper copy, $0.95 in microfiche. See also AD-704 268 and AD-434 346. Journal of Applied Physics, Vol 40, No 8, p 3105-3114, July 1969. 11 fig, 39 ref.
Identifiers: *Sea ice, Electrical properties, Salinity, Dielectric properties, Temperature, Impurities, Canada, Remote areas.

Results are presented of a study of the (Normalized) complex dielectric coefficient and related parameters, of unidirectionally frozen artificial sea ice having salinities from 4 to 20%. The frequency dispersion was investigated between 20 Hz and 100 MHz at temperatures from minus 35 to minus 12.5C. An unusual measurement cell, which becomes incorporated into the ice as it forms, is described and justification offered for its use. The electrical properties changed most rapidly with temperatures near minus 23C, the NaCl deposition temperature. (See also W71-01533)
W71-01532

THE ELECTRICAL PROPERTIES OF SALINE ICE,
McGill Univ., Montreal (Quebec). Dept. of Physics.
J. R. Addison, and E. R. Pounder.
Available from NTIS as AD-704 268, $3.00 in paper copy, $0.95 in microfiche. Physics of Snow and Ice, Proceedings of the International Conference on Low Temperature Science, 1966, Vol 1, Pt 1, 1967, p 649-660. 9 fig, 27 ref. Contract Nonr-4417 (00).
Identifiers: *Sea ice, Electrical properties, Salinity, Resistance (Electrical), Impurities, Dielectric properties, Symposia, Canada, Remote areas.

Results of a current study of the (normalized) dielectric coefficient and the equivalent parallel resistivity of unidirectionally frozen saline ice are given. Frequencies ranged from 20 Hz to 100 MHz. Salinities were of the order 7-20 p.p.t. A detailed study of frequency dependence was carried out at minus 22C. Resistivities ranged from 10 to 1000 ohm-meters, decreasing slowly with increase in frequency. The effect of variation of temperature was also studied. A cell, with metalized nylon mesh electrodes, which become incorporated into the ice as it grows, is described, along with experimental justification for its use. (See also W71-01532)
W71-01533

2D. Evaporation and Transpiration

EVAPORATION FROM SNOW AND EVAPORATION RETARDATION BY MONOMOLECULAR FILMS. A REVIEW OF LITERATURE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 03B.
W71-01143

THE DETERMINATION OF SUITABLE AVERAGE VALUES OF METEOROLOGICAL DATA FOR USE IN ESTIMATION OF EVAPOTRANSPIRATION,
North Dakota Water Resources Research Inst., Fargo.
John C. Hudson, Joseph R. Schwendeman, and Duane L. Younggren.
Available from NTIS as PB-195 665, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, WI-221-008-70, North Dakota Water Resources Research Institute, June 1970. 16 p, 3 tab, 2 fig, 21 ref. OWRR Project A-008-NDAK (1).

Descriptors: *Evapotranspiration, *Micrometeorology, *Evaporation, Humidity, Solar radiation, Soil temperature, *Water loss, North Dakota, Meteorology.

A quantitative analysis of evapotranspiration was carried out at the University of North Dakota Meteorological Station. From data collected on a daily basis during the summer of 1967, several linear regression models predicting evapotranspiration were derived. The variables used in the study were actual evapotranspiration (dependent), air temperature, relative humidity, air movement, water loss from an open pan, and soil temperature (independent). The model providing the best fit yielded a multiple correlation coefficient of R — .49321. A simplified predictive equation for evapotranspiration was obtained, using only pan loss and soil temperature as independent variables. In this case, R — .45792, indicating little loss in prediction. The single variable correlating most highly with evapotranspiration was maximum air temperature, for which R — .4291. These values are interpreted as surrogates for actual evapotranspiration information. Better prediction was achieved in the case of estimating water loss from an open pan. Using relative humidity, total air movement, maximum air temperature, and soil temperature as independent variables, a multiple correlation, R — .78954, was obtained.
W71-01190

THE EFFECTS OF SURFACE PROPERTIES OF WATER ON EVAPORATION AND CONDENSATION,
Rochester Inst. of Tech., N.Y.
For primary bibliographic entry see Field 02K.
W71-01198

EVAPORATIVE WATER LOSS FROM THE DESERT IGUANA, DIPSOSAURUS DORSALIS,
Michigan Univ., Ann Arbor. Dept. of Zoology.
John E. Minnich.
National Science Foundation Grant GB-6230. Copeia, No 3, p 575-578, 3 September 1970. 1 fig, 14 ref.

Descriptors: *Xerophilic animals, *Reptiles, *Evaporation, *Moisture deficit, *Weight, Laboratory tests, Arid lands, Animal physiology, Vapor pressure, Humidity, Water loss, Temperature, Animal metabolism, Permeability, Burrows, Moisture deficit, Physiological ecology.
Identifiers: *Desert Iguana, *Body weight, *Body surface area, *Relative humidity, *Integument, Skin sloughing, Fossorial animals, Saturation deficit.

Above ground on a summer day, at 42 degrees C. and 15 mm Hg vapor pressure, the desert iguana is subjected to a moisture saturation deficity (SD) of 45.5 mm Hg. At night, in a burrow of 12 in. depth and a temperature of 39 degrees C., the SD is 22.8 mm Hg. Measurements of evaporative water loss were performed under these conditions in a controlled laboratory environment. With resting animals the slope of a log-log curve of evaporative water loss vs. body weight was very close to -0.33, suggesting that evaporative water loss is related to body surface area. Water loss rates increase 2-to 5-fold in active animals and also increase during skin shedding which is likely due to a transient increase in skin permeability. Oxidative water production at low humidities seems insignificant. During activity under these conditions, adult animals lost 0.86% of their body weight/day through evaporation, which represents about 28% of their daily water turnover in nature. (Casey-Arizona)
W71-01290

HYGROSCOPIC ADDITIVES TO PHENOXY HERBICIDES FOR CONTROL OF SALTCEDAR,
Agricultural Research Service, Los Lunas, N. Mex. Crops Research Div.
For primary bibliographic entry see Field 03B.
W71-01405

2E. Streamflow and Runoff

THE OCCURRENCE AND GEOLOGIC WORK OF RIP CURRENTS OFF SOUTHERN CALIFORNIA,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W71-01102

A RECONNAISSANCE OF THE WATER RESOURCES IN THE PORTNEUF RIVER BASIN, IDAHO,
Geological Survey, Boise, Idaho.
R. F. Norvitch, and A. L. Larson.
Idaho Department of Reclamation Water Information Bulletin No 16, June 1970. 58 p, 18 fig, 5 tab, 37 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, Idaho, Topography, Climatic data, Drainage, Geologic formations, Hydrogeology, Aquifer characteristics, Springs, Wells, Water levels, Streamflow, Runoff, Floods, Discharge measurement, Water quality, Irrigation, Water supply, Industries, Municipal water, Hydrographs.
Identifiers: Landforms, Upper valley drainage, Lower valley drainage.

The part of the Portneuf River basin described includes an area of about 1,160 square miles in southeastern Idaho. It lies on the Columbia River side of the divide between the Columbia River basin and the Great Basin drainages. Hydrologic data collected during the reconnaissance are illustrated and discussed. Hydrologic problems that have resulted from use of the water resources are pointed out, and the scope required of some future project aimed at describing more fully the water resources of the basin is presented. The work accomplished during this reconnaissance, made in the period July 1968 to June 1969, consisted of (1) a partial inventory of water wells in the basin; (2) establishment of new stream-gaging sites and groundwater observation wells; (3) geologic and hydrologic mapping; (4) mapping of areas irrigated with groundwater; (5) an evaluation of the use of ground and surface water for irrigation; (6) an evaluation of the interrelation between surface and groundwater; (7) a generalized appraisal of the chemical quality of the water resources; and (8) an evaluation of the need for and the possible methods that could be used to make a comprehensive quantitative study of the water resources of the basin. (Woodard-USGS)
W71-01104

UNSTEADY FREE-SURFACE FLOW COMPU TATIONS,
Michigan Univ., Ann Arbor. Dept. of Civil En gineering.
For primary bibliographic entry see Field 08B.
W71-01108

INDETERMINATE HYDRAULICS OF ALLUV AL CHANNELS,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02J.
W71-01110

ALLUVIAL RIVER BEHAVIOR - A FEW ASPECTS OF ITS SIMULATION IN A MODEL,
For primary bibliographic entry see Field 08B.
W71-01211

COMPUTER SIMULATION OF RIVERBE DEGRADATION AND AGGRADATION BY TH METHOD OF CHARACTERISTICS,
South Dakota State Univ., Brookings.
Fred F. M. Chang.
French resume included. In: Proceedings 13 Congress of the International Association f Hydraulic Research, Kyoto, Japan, August 31-Se tember 5, 1969, Vol 1 (Subject A), Science Cou cil of Japan, Kyoto, p 337-344, 1969. 8 p, 1 fig, ref.

Descriptors: *Simulation analysis, *Mathematic models, *Sediment transport, *Alluvial channe *Aggradation, Degradation (Stream), Erosio Deposition (Sediments), Bed load, Mathematic studies, Computer programs.
Identifiers: Method of characteristics.

For unsteady flow in alluvial channels, thr characteristic equations can be derived from thr basic equations. However, this introduces ma computational difficulties, and only a graphic so tion has been developed. In order to avoid the difficulties, two characteristic equations derived from three basic equations. By assumi that the deposit of sediment is uniformly d tributed in a short reach, three basic equations successfully reduced to two basic equations a then, from them, the two characteristic equatio are derived. The computing procedures are divid into two parts: (a) to compute the average veloc and the depth of sediment-laden flow by t characteristic equations, and then, (b) to estim the deposition of sediment by using the continu equation of sediment. (Knapp-USGS)
W71-01212

DATA-REVERSIBLE SYSTEMS FOR FLO ROUTING,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 06A.
W71-01213

SIMULATION TECHNIQUES IN WAT RESOURCES SYSTEMS,
State Hydraulic Works, (Turkey). Dept. Research.
Sahap Aksoy.
French resume. In: Proceedings 13th Congres the International Association for Hydra Research, Kyoto, Japan, August 31-Septembe 1969, Vol 1 (Subject A), Science Council of Jap Kyoto, p 221-230, 1969. 10 p, 4 fig, 2 ref.

Descriptors: *Hydraulic models, *Hydra similitude, *Sediment transport, *Alluvial ch nels, Mathemathical studies, Flumes, Closed c duit flow, Open channel flow.
Identifiers: Pressure models (Hydraulic).

The design and some similarity analyses of press models suitable for investigation of movable- river problems are discussed. The similarity co tions are introduced by analyzing the fundame equations of flow and sediment transportation

ıovable bed models along it is usually impossible
› meet all similarity requirements. The scale-ef-
ects for flow and solid material transport may be
orrected by the given methods. (Knapp-WSGS)
/71-01215

LECTRONIC ANALOGUES REPRESENTING ONLINEAR FLOW THROUGH OPEN CHAN-ELS AND FLOOD CONTROL STRUCTURES,
entral Water and Power Research Station, Poona
ndia).
or primary bibliographic entry see Field 08B.
/71-01217

CCURACY OF THE NUMERICAL SOLUTION OR GENERAL UNSTEADY RIVER FLOW QUATION,
akeshi Ito, Hiroshi Fujii, and Sumihisa Ohira.
rench resume included. In: Proceedings 13th
ongress of the International Association for
ydraulic Research, Kyoto, Japan, August 31-Sep-
mber 5, 1969, Vol 1 (Subject A), Science Coun-
l of Japan, Kyoto, p 429-437, 1969. 9 p, 3 fig, 3
f.

escriptors: *Unsteady flow, *Routing, *Water
orage, Flood forecasting, Streamflow, Discharge
Water), Equations, Mathematical studies, Stage-
scharge relations.

this paper a scheme is described for the digital
mputation of discharges and water levels in
vers when the flow is unsteady. The results of cal-
ılation prove that the conservation law of water is
alized; that is, the difference between inflow and
ıtflow is storage in calculated sections of streams.
Knapp-USGS)
/71-01223

MATHEMATICAL MODEL OF UNSTEADY LOW IN A NATURAL OR ARTIFICIAL VATER COURSE,
attenbyggnadsbyran, Stockholm (Sweden).
ennart Rundgren.
rench resume included. In: Proceedings 13th
ongress of the International Association for
ydraulic Research, Kyoto, Japan, August 31-Sep-
mber 5, 1969, Vol 1 (Subject A), Science Coun-
l of Japan, Kyoto, p 511-518, 1969. 8 p, 4 fig, 1
f.

escriptors: *Unsteady flow, *Open channel flow,
Mathematical models, Regulation, Flood control,
age-discharge relations, Channel morphology,
omputer programs, Water storage, Reservoir
peration, Hydrologic budget.

model is developed for the calculation of the
ater level and the water flow in any part of a natu-
l river or other water course as a function of time.
he model facilitates the estimate of the backwater
ffect of a dam or other obstacles placed in the
ater course with due regard to variations in in-
ow, evaporation losses and rainfall. The model is
pecially useful for the estimation of flow varia-
ons along a vier where the discharge is being regu-
ted. (Knapp-USGS)
/71-01224

MPLITUDE-DISSIPATIVE AND PHASE-DIS-PATIVE SCHEMES FOR HYDRAULIC JUMP IMULATION,
echnische Hogeschool, Delft (Netherlands).
or primary bibliographic entry see Field 08B.
/71-01225

HE CALCULATION OF FLOOD HYDRO-RAPHS IN SOME RIVER SYSTEMS IN GER-ANY,
echnische Hochschule, Brunswick (West Ger-
any).
iedrich Zimmermann, and Ulrich Maniak.
: Proceedings 13th Congress of the International
ssociation for Hydraulic Research Kyoto, Japan,
August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 379-383, 1969. 5 p, 2 fig.

Descriptors: *Mathematical models, *Hydrograph analysis, *Flood routing, Flood forecasting, Routing, Mdoel studies, Regulation, Flood control, Water management (Applied).
Identifiers: Germany.

A mathematical model is used for investigations of the Aller-River-System in Northern Germany with a catchment area of some 16,000 sq km and a total length of the water courses investigated of approximately 500 km. The river near its confluence with the Weser River has an average discharge of 110 cu m/sec and maximum flood of 1500 3 cu m/sec. The mathematical model covers floodwater discharges in the Aller River and its major tributaries the Oker, Innerste and Leine Rivers. The first inflow hydrograph is identical with an observed hydrograph at a watergage in the beginning of the reach investigated. At every water gage in the intermediate reach the calculation is compared with the observed hydrograph. To fit the calculated hydrograph to the computed hydrograph it is necessary to introduce correction coefficients. (Knapp-USGS)
W71-01226

MATHEMATICAL MODELLING ON DIGITAL COMPUTERS AND CALCULATIONS FOR MULTI-PURPOSE UTILIZATION OF STREAM-FLOW,
For primary bibliographic entry see Field 06A.
W71-01228

THE ANALYSIS OF UNSTEADY FLOW IN RIVERS BY AN ANALOGUE COMPUTER,
Public Works Research Inst. Tokyo (Japan).
For primary bibliographic entry see Field 07C.
W71-01230

A NEW RATIONAL METHOD FOR CALCULATION OF MAXIMUM FLOOD DISCHARGE BY AMOUNT OF RAINFALL IN THE CATCHMENT,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
Tae Sang Won.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research , Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 133-143, 1969. 11 p, 6 fig, 1 ref.

Descriptors: *Flood forecasting, *Rational formula, *Peak discharge, *Rainfall-runoff relationships, Precipitation intensity, Watersheds (Basins), Equations, Runoff forecasting, Flood control, Water management (Applied), Hydrograph analysis.
Identifiers: Isochron methods.

An extension of the rational method was developed for calculation of maximum river flood discharge with variable intensity of rainfall. A reasonable method of division of a complicated drainage basin which consists of numerous tributaries into isochronic zones is suggested. This method of calcuation of flood discharge is applicable for the design of sewers and river improvement works. (Knapp-USGS)
W71-01234

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF,
Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02A.
W71-01235

METHODS OF CALCULATING STEADY AND UNSTEADY CURRENTS IN HOMOGENEOUS LAKES,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02H.
W71-01244

FLOW PATTERN OF DENSITY CURRENT AT A RIVER MOUTH,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
Masakazu Kashiwamura, and Shizuo Yoshida.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 181-190, 1969. 10 p, 14 fig, 6 ref.

Descriptors: *Density currents, *Saline water-freshwater interfaces, Streamflow, Density stratification, Stratified flow, Oceans, Estuaries, Saline water intrusion, Hydraulic models, Mixing, Dispersion, Turbulence, Turbulent flow.
Identifiers: Mixing patterns (river water-sea water).

Flow patterns of fresh streams entering salt water are classified through experiments into five patterns, from A to E. The A pattern flow has the character of a density current and its stream lines are stable without turbulence. The E pattern flow resembles a plane jet of a single fluid, which grows with turbulence and secondary currents. Other patterns, B. C, and D, are transitional between those two. Distributions of velocity and specified gravity are also discussed for every pattern, and experimental results and field observations are illustrated and compared. (Knapp-USGS)
W71-01255

FLOW DISTRIBUTION IN STREET INTERSECTIONS AS DETERMINED BY EXPERIMENTAL HYDRAULIC MODEL STUDIES.
Los Angeles Bureau of Engineering, Calif. Storm Drain Div.

City of Los Angeles Bureau of Engineering, Storm Drain Design Division, Los Angeles, California, 1952-1953. 63 p, 59 fig.

Descriptors: *Flow rates, *Flow measurement, *Water measurement, *Drainage systems, *Hydraulics, *Open channel flow, *Drainage engineering, *Drainage practices, *Model studies, *Road design, Urbanization, Hydraulic models, Hydraulic engineering, Drainage water, California.
Identifiers: *Street intersections, *Street drainage, *Urban drainage, Experimental models, Los Angeles (Calif).

The publication is an assembly of 59 different sets of charts which can be used in designing urban streets and drainage systems. The charts were developed for determining storm runoff flow distribution in right-angle street intersections. Each chart reflects predetermined prototype inflow quantities of water which may reach a right angle cross-street intersection from two directions under varying conditions of street widths, slopes, crowns, and crossfalls. Based upon a given set of conditions, the distribution of the combined inflow can be determined at the street intersection as it emerges from the intersection, in the two outflow street sections. These calculated quantities can then be used in the design of street stormwater inlets, catch basins and storm sewers. The charts were developed from experimental hydraulic model studies conducted by the City of Los Angeles over a 16 month period. The models were built to a 1:15 scale. Much of the data was developed from an adjustable model, in which the significant physical parameters could be varied to simulate prototype conditions worthy of study. Initially, the work was jointly sponsored by the California State Division of Highways and the City of Los Angeles. The City later continued and expanded the studies to result in the subject publication. (Poertner)
W71-01334

SOME EFFECTS OF URBANIZATION ON FLOODS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 04C.
W71-01336

A NUMERICAL DETERMINATION OF SALT WEDGE MOVEMENTS,
F. Boulot, and P. Braconnot.
Houille Blanche, No 8, p 871-877, 1967. Transl from Fr, TT 70-58139, 1970. 15 p, 10 fig, 8 ref.

Descriptors: *Numerical analysis, Sea water, *Sea water intrusion, Rivers, *Estuaries, Interfaces, Unsteady flow, Differential equations, Equations, Foreign research, Streamflow, Movement, Finite differences, Boundaries (Surfaces), Mathematical analysis, Characteristics, *Saline water-freshwater interfaces, *Saline water, Hydrology, Hydraulics.
Identifiers: Salt front, France, Boundary conditions, Saline-nonsaline interfaces.

Salt water wedges are likely to form in river estuaries under certain flow conditions and eventually extend several kilometers upstream. Where the riverbed is fairly even and the tide not strong enough for total flow reversals to take place, and when no sudden discharge variations occur, there is little exchange between the 2 layers and an interface can be assumed to exist. Slight exchange does take place frequently, and the interface can be defined as the locus of points at which the fluid density is the mean of the 2 layers. The problem of salt water movement in river estuaries is one of unsteady flow of 2 liquids of different densities with a free surface and an interface. Equations assuming gradually varying flows lead to a system of 4 partial differential equations in terms of time and abscissa calculated along the stream. A numerical resolution of this differential system is presented. (USBR)
W71-01389

ST LOUIS SAN FRANCISCO RY V MANNING (RAILROAD'S LIABILITY FOR DESTROYING NATURAL PROTECTION FROM RIVER OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-01519

STREAM CATALOG OF SOUTHEASTERN ALASKA REGULATORY DISTRICT NOS. 14 and 15.
Alaska Dept. of Fish and Game, Juneau.

Available from NTIS as PB-191 160, $3.00 in paper copy, $0.95 in microfiche. U.S. Fish and Wildlife Service Data Report 45, February 1970. 208 p. Contract DI-14-17-0005-24.
Identifiers: *Rivers, *Catalogs, *Fishes, Alaska, *Alaska, Rivers, Law, Geography, Classification, Weather, Temperature, Surveying, Airborne, Reproduction (Physiology), Site selection, Indexes, Maps, Fisheries, Spawning, *Salmon streams, *Stream catalog, Remote areas.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game; the Alaska Salmon Industry; the Fisheries Research Institute of the University of Washington; the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries; and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 69 salmon streams in Southeastern Alaska Regulatory Districts 14 and 15. Each stream is located geographically by latitude and longitude and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of streams are listed. Physical descriptions are presented for the intertidal zone and the upstream areas of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon using the spawning grounds and estimates of the escapements each year for many years are given. (See also W71-01542 and W71-01543).
W71-01541

STREAM CATALOG OF SOUTHEASTERN ALASKA REGULATORY DISTRICT NO 12.
Alaska Dept. of Fish and Game, Juneau.

Available from NTIS as PB-191 161, $3.00 in paper copy, $0.95 in microfiche. US Fish and Wildlife Service Data Report 46, March 1970. 222 p. Contract DI-14-17-0005-24.
Identifiers: *Rivers, *Catalogs, *Fishes, Alaska, *Alaska, Rivers, Law, Geography, Classification, Weather, Temperature, Surveying, Airborne, Reproduction (Physiology), Site selection, Indexes, Maps, Fisheries, Spawning, *Salmon streams, *Stream catalogs, Remote areas.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game; the Alaska Salmon Industry; the Fisheries Research Institute of the University of Washington; the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries; and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 58 salmon streams in Southeastern Alaska Regulatory District 12. Each stream is located geographically by latitude and longitude and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of streams are listed. Physical descriptions are presented for the intertidal zone and the upstream areas of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon using the spawning grounds and estimates of the escapements each year for many years are given. (See also W71-01541 and W71-01543).
W71-01542

STREAM CATALOG OF SOUTHEASTERN ALASKA REGULATORY DISTRICTS NOS. 10 and 11.
Alaska Dept. of Fish and Game, Juneau.

Available from NTIS as PB-191 159, $3.00 in paper copy, $0.95 in microfiche. US Fish and Wildlife Service Data Report 44, February 1970. 267 p. Contract DI-14-17-0005-24.
Identifiers: *Rivers, *Catalogs, *Fishes, Alaska, *Alaska, Rivers, Law, Geography, Classification, Weather, Temperature, Surveying, Airborne, Reproduction (Physiology), Site selection, Indexes, Maps, Fisheries, Spawning, *Salmon streams, *Stream catalogs, Remote areas.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game; the Alaska Salmon Industry; the Fisheries Research Institue of the University of Washington; the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries; and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 71 salmon streams in Southeastern Alaska Regulatory Districts 10 and 11. Each stream is located geographically by latitude and longitude and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of streams are listed. Physical descriptions are presented for the intertidal zone and the upstream area of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon using the spawning grounds and estimates of the escapements each year for many years are given. (See also W71-01541 and W71-01542).
W71-01543

LEITCH V SANITARY DIST OF CHICAGO (RIPARIAN RIGHT TO UNOBSTRUCTED FLOW OF RIVER).
For primary bibliographic entry see Field 06E.
W71-01577

2F. Groundwater

CARBON-14 AGES RELATED TO OCCURRENCE OF SALT WATER,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-01107

VARIATIONAL APPROACH TO NON-DARCY FLOW,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01109

THE USE OF LINEAR PROGRAMMING FOR ESTIMATING GEOHYDROLOGICAL PARAMETERS OF GROUNDWATER BASINS,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
David Kleinecke.
Available from NTIS as PB-195 668, $3.00 paper copy, $0.95 in microfiche. TEMP Report 70TMP-43, July 1970. 31 p, 1 tab, 8 ref. OWRR Project C-1339 (No 1971) (1).

Descriptors: *Aquifer characteristics, *Computer models, Data collections, Groundwater movement, *Groundwater basins, *Hydrogeology, *Linear programming, *Mathematical models, Model studies, *Simulation analysis.

Simulation models of groundwater basins require estimates of geohydrological parameters such as permeability and storage capacity. In present practice these parameters are initially guessed at and later adjusted by trial and error to improve the model's ability to simulate some known portion of the water history. It has been suggested that the process might be reversed to deduce geohydrology directly from the historical record. This suggestion was tested against a basin studied earlier by the California State Department of Water Resources. The fitting criteria used gave rise to linear programming formulations which were solved from the basin data. The approach shows promise in that about one-third of the basin parameters were evaluated, but further development is required. It is believed that historical records, although apparently overdetermining the system of equations, actually underdetermine the system because of redundancy effects. The approach appears to offer the best known method for estimating the effective aquifer depth. (See also W71-01194)
W71-01193

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
Charles F. Meyer.
Available from NTIS as PB-195 669, $3.00 paper copy, $0.95 in microfiche. TEMPO Report 70TMP-49, July 1970. 34 p, 4 fig, 1 tab, 28 ref. OWRR Project C-1339 (No 1971) (2).

Descriptors: *Aquifer characteristics, *Computer models, *Data collection, *Groundwater movement, Groundwater basins, Hydrogeology, Linear programming, *Mathematical models, Model studies, Monte Carlo method, Optimization, Project planning, *Simulation analysis, Water management.

In constructing a plausible mathematical model of a groundwater basin, including the flow equation and the data describing the physical parameters of the basin, use of a series of experimental mod

nay be found to be the minimal-cost approach to guiding data,gathering programs while simultaneously developing a plausible model to be used for predicting the consequences of management decisions such as increasing or decreasing the amount of water to be withdrawn in various parts of the basin. The basis for experimentation is a sensitivity analysis, for which triangular and log-triangular distributions are suggested as appropriate methods for perturbing known values of parameters into 'erroneous' values. The worth of improving the accuracy of measurements or estimates can be evaluated empirically by use of these techniques. Automated techniques for deducing basin parameters from histories of water levels were developed but were not fully successful. Use of linear programming shows some promise but requires further development before being routinely applicable. (See also W71-01193)
W71-01194

GROUND WATER QUALITY IN STANLY COUNTY, NORTH CAROLINA,
North Carolina State Dept. of Water and Air Resources, Raleigh.
Edward L. Berry.
North Carolina Department of Water Resources Ground Water Circular No 15, August 1970. 24 p, 1 fig, 3 tab, 8 ref.

Descriptors: *Groundwater, *Water quality, Chemical analysis, Data collections, Water sources, Water pollution, Hydrology, Water table, Bacteria, Coliforms, Water wells, Logging (Recording), Groundwater basins, Surface waters, Infiltration, North Carolina.
Identifiers: Stanly County (North Carolina).

Groundwater was studied to ascertain the extence, source, and extent of any bacteriological pollution which might be detrimental to the environmental health of Stanly County, North Carolina residents. Chemical and physical analyses of water and well data from this study and previous studies show that groundwater of suitable quantity and quality for domestic and other water needs is available throughout Stanly County. The groundwater supply of the County is not polluted. Pollution of individual wells has occurred as a result of poor construction and improper finishing of wells. Poorly constructed and finished wells are numerous in the county. There is no evidence that the Rocky and Yadkin Rivers are a source of groundwater pollution. Data concerning topography, geology, geophysical logs, water tables, well-numbering grid system, and water analyses are shown. (Woodard-USGS)
W71-01203

IN ANALYSIS OF RUNOFF MODELS,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01232

MATHEMATICAL MODEL OF THE BIG BEND WELL FIELD,
Southwestern Ohio Water Co., Cincinnati; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Robert C. Lewis, and Louis M. Laushey.
French summary included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 503-509, 1969. 7 p, 1 fig, 2 tab, 1 ref.

Descriptors: *Water levels, *Withdrawal, Aquifers, *Ohio, *Mathematical models, Data collections, Data processing, Optimization, Systems analysis, Water level fluctuations, Water wells, Water yield, Hydrologic data, Hydrogeology.
Identifiers: Big Bend Well Field (Ohio).

Continuous withdrawals of substantial quantities of groundwater have been made from the Big Bend area of the Great Miami River aquifer in southwestern Ohio since 1952. Extensive data have been collected since 1952 on groundwater levels, influent surface stream elevations, and metered quantities of water pumped from the well field. A mathematical model was developed to correlate groundwater withdrawal, rainfall infiltration, and river recharge with changes in storage in the aquifer between 1959 and 1968. An electrical analog model of convenient scale was constructed to simulate the performance of the well field under various conditions of recharge and discharge. The mathematical model is used to calculate the maximum safe yield for the Big Bend well field for the maximum utilization of the aquifer. (Knapp-USGS)
W71-01236

SPECIAL CASES OF WATER SUPPLY INTERFERENCE CAUSED BY URBAN DEVELOPMENT NEAR TORONTO, ONTARIO, CANADA,
Ontario Water Resources Commission, Toronto.
Donald N. Jeff, and Jaak Viirland.
Water Resources Bulletin, Vol 6, No 5, October 1970, p 746-753. 4 fig, 4 ref.

Descriptors: *Water supply, *Urbanization, Wells, Cities, Surface waters, Groundwater, Surface-groundwater relationships.
Identifiers: *Water supply interference, *Urban development.

Since 1961, control over water-supply interference problems in the Province of Ontario has been provided under the Ontario Water Resources Commission Act. A section of the act requires persons taking more than 10,000 imperial gallons per day of water for purposes other than domestic, stock or fire-fighting to have a permit and to take the water in accordance with specified terms and conditions. In cases of serious interference, the Commission has required that steps be taken to restore water supplies or prevent continued interference. Construction of some new wells, sewers, and roads to meet the needs of urban development has caused interference with both ground-and surface-water supplies. Two cases are described where municipalities in the Toronto area restored supplies to overcome serious interference with several private wells and streamflow during testing and operation of a 500 imperial gpm municipal well adjacent to a normally effluent stream, and varying degrees of interference with private wells caused by dewatering at rates up to 2000 imperial gpm from the installation of a trunk sewer. (Davis-Chicago)
W71-01363

NUMERICAL SOLUTION OF THE BOUSSINESQ EQUATION FOR AQUIFER-STREAM INTERACTION,
Stanford Univ., Calif.
George M. Hornberger, Janet Ebert, and Irwin Remson.
Water Resources Research, Vol 6, No 2, p 601-608, Apr 1970. 8 p, 9 fig, 23 ref.

Descriptors: *Numerical analysis, Aquifers, Streams, *Groundwater flow, Groundwater movement, Base flow, Streamflow, Mathematical models, Mathematical analysis, Finite differences, Analogs, Hydrology, Flood waves, Hydrograph analysis, Groundwater, Water level fluctuations, Bibliographies.
Identifiers: *Boussinesq equation, Comparative studies, Porous media flow, Finite difference method, Groundwater hydrology.

An efficient numerical technique is used to obtain solutions of the Boussinesq equation for problems of groundwater recession and groundwater flow in response to changes in stream stage. Comparison of the numerical results with the analytical solution of Boussinesq attests to the accuracy of the former. Solving a recession problem indicates that the form of the Werner and Sundquist model of groundwater discharge recession is appropriate. Solving a problem involving changing boundary conditions on an aquifer because of a flood wave provides data relative to groundwater outflow. A comparison with the results of Cooper and Rorabaugh evaluates the applicability of a linear model of unconfined flow. (USBR)
W71-01379

2G. Water in Soils

A SEMI-QUANTITATIVE HYDROLOGICAL CLASSIFICATION OF SOILS IN NORTH-EAST ENGLAND,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
D. T. Edmonds, R. B. Painter, and G. D. Ashley.
Journal of Soil Science, Vol 21, No 2, p 256-264, September 1970. 9 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Rainfall-runoff relationships, *Infiltration, *Permeability, *Soil water movement, *Soil classifications, Subsurface runoff, Open channel flow, Hydrograph analysis, Base flow, Floods, Peak discharge, Depth-area-duration analysis, Flood routing.
Identifiers: England, Flood-wave formation.

Multiple regression equations relating the times-to-peak of flood hydrographs on 26 rivers in NE. England with the characteristics of causative rainfall and those of the relevant river basin, showed flood-wave formation to be largely dependent on storm duration and the average minimum infiltration rate of the soil. Other significant factors were the initial flow in the river, temporal variation of rainfall during a storm, and main river channel length and slope. A semi-quantitative hydrological classification was made of the soils in Northumberland, Durham, and Yorkshire, together with parts of Lancashire, Cumberland, and Westmorland, based on a ranking of their probable minimum infiltration rates. (Knapp-USGS)
W71-01106

WET STRENGTH OF SILICA-DILUTED SYNTHETIC SOIL AGGREGATES,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
Chyi-sheng Hwang.
M.S. Thesis, Minnesota University Graduate School, October 1969. 48 p, 12 fig, 9 tab, 38 ref. OWRR Project No B-015-MINN (2).

Descriptors: *Soil aggregates, *Cement grouting, *Soil sealants, Wetting, Silica, Quartz, Soil cement, Clay loam, Silts, Silicates, Bonding, Oxidation, Soil moisture, Infiltration, Crop production, Soil management.
Identifiers: *Experimental soils, Silicic acid, Moisture retention, Synthetic soil aggregates, Glassbeads.

The cementing effect of silica incorporated into synthetic soil aggregates were investigated. Synthetic soil aggregates were made of Clarion clay loam or Port Byron silt loam soils diluted with spherical glassbeads or with angular quartz sand of various quantities and sizes. The relative stabilities of the synthetic soil aggregates were determined by use of the wet sieving method. Synthetic aggregates from both soil generally decreased in stability as size of added quartz increased. However, angular quartz gave an increase in stability of Clarion clay loam aggregates as quartz particle size increased from 38 to 120 microns. At low dilution rates stability appeared to increase as particle size increased to 390 microns on this soil. Stability of aggregates was lower when diluted by spherical glassbeads than by angular quartz sand. On Clarion clay loam this difference was very marked. An expression of the empirical relationship between stability, size and quantity of added quartz was derived. (Woodard-USGS)
W71-01112

ESTIMATES OF FIELD INFILTRATION INTO LAYERED SOILS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Civil Engineering; and Clemson Univ., S.C. Dept. of Agricultural Engineering.
Riaz Ahmed, and James T. Ligon.
Paper No 69-740 presented at American Society of Agricultural Engineers Winter Meeting, Chicago, Illinois, December 9-12, 1969. 23 p, 10 fig, 17 ref. OWRR Project A-003-SC (8).

Descriptors: *Infiltration, *Soil water movement, *Water, Rates, Moisture content, Numerical analysis, Equations, Plants, Soil moisture, Moisture tension, Diffusivity.
Identifiers: *Moisture flow equation, Infiltration curves, Infiltration rate.

Infiltration rate curves were computed using a numerical solution of the unsaturated moisture flow equation. These curves were compared with actual field infiltration curves obtained with a Purdue-type sprinkler infiltrometer. The computed and observed infiltration curves compared reasonably well except in the early part of each run. (Woodard-USGS)
W71-01113

AN EVALUATION OF PREDICTIVE METHODS OF DETERMINING THE EFFECTS OF SOLID-LIQUID PHASE INTERACTIONS ON THE MOVEMENT OF SOLUTES IN SOILS,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. C. Routson.
Available from NTIS as BNWL-1196, $3.00 in paper copy, $0.95 in microfiche. November 1969, 10 p. AEC Res and Dev Rpt BNWL-1196.
Identifiers: *Radiation shielding, *Scattering cross sections, *Tungsten, *Uranium, Capture effect, Lithium hydrides, Neutron irradiation, Resonance scattering.

An evaluation was made of the available methods, theories, and models which have been used to describe solid-liquid phase interactions which take place in porous media. Only the discontinuous-fixed plate model of Dutt was found to be a multiion approach which prior work on the Hanford project has shown to be necessary for a successful sorption description. The combination of Dutt's macroion approach and an empirical-statistical method of measuring trace radionuclide sorption was deemed to be the most fruitful approach for describing radionuclide concentration as a function of position and time. A computer program has been written and experiments have been designed to measure model parameters for testing the aforementioned approach.
W71-01121

LEACHATE MOVEMENT IN THE SUB-SOIL BENEATH A SANITARY LANDFILL TRENCH TRACED BY MEANS OF SUCTION LYSIMETERS,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 05B.
W71-01204

SALT-FERTILIZER-SPECIFIC ION INTERACTIONS IN SOIL,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 03C.
W71-01283

SOIL PHYSICAL PROPERTIES ALTERED BY ADSORBED HYDROPHOBIC MATERIALS,
Dow Chemical Co., Midland, Mich.
G. H. Brandt.
In: Symposium on Water-Repellent Soils, Proceedings, University of California, Riverside, May 6-10, 1968, p 205-220, March 1969. 7 fig, 1 tab, 18 ref.

Descriptors: *Wettability, *Soil physical properties, *Adsorption, *Soil compaction, *Soil sealants, Soil structure, Soil water movement, Soil tests, Soil treatment, Soil investigations, Laboratory tests, Cohesion, Compaction, Compressibility, Moisture content, Density, Clays, Montmorillonite, Slurries, Chemicals, Repellents.
Identifiers: *Water-repellent soils, *Hydrophobic materials, Swelling.

Most of the physical effects of adsorbed hydrophobic materials are related to their influences on water adsorption and water structure adjacent to soil grains. The compressivities of several soils as measured by immersed strength increased with increasing amounts of hydrophobe, 4-tert-butylcatechol (TBC). Some, but not all, hydrophobes increase compactibility. Cohesive soil strengths as measured by relative anticrusting ability is affected by hydrophobes, but cannot be directly correlated with their soil waterproofing ability. X-ray data on TBC and 2-amino-4-t-butylphenol indicate that these substances are adsorbed on the edges of clay grains, blocking their expansion. The hydrophobic substances most effective in waterproofing are also most effective in limiting clay swelling. These effects are related to alteration of hydrostatic repulsion forces between soil grains. (Casey-Arizona)
W71-01291

ECOLOGICAL EFFECT OF A CLAY SOIL'S STRUCTURE ON SOME NATIVE GRASS ROOTS,
South Dakota State Univ., Brookings. Dept. of Agronomy.
E. M. White, and J. K. Lewis.
Journal of Range Management, Vol 22, No 6, p 401-404, 1969. 2 tab, 22 ref.

Descriptors: *Soil structure, *Great Plains, *Grasses, *Root systems, *Clays, Ecology, Soil texture, Soil groups, Soil classification, Soil physical properties, Soil-water-plant relationships, Range grasses, Grama grasses, Wheatgrasses, Wilting point, Wettability, Rainfall, Drying, Cracking, Fine-textured soils.
Identifiers: *Peds.

In the Northern Great Plains, the Clayey Range Soil Group supports an understory of short- and mid-grasses while the Dense Clay Range Soil Group supports no short grasses. This is the main criterion in differentiating these fine-textured soil groups since attempts to do so on the basis of texture and dispersion have been unsatisfactory. Efforts were made, therefore, to differentiate these soils on the basis of structure. At wilting point the peds of Clayey range soils are smaller, with more distinct prisms than those of Dense Clay range soils. This is indicative of the differing shrink-swell forces on roots in the 2 soils. The larger peds of the Dense Clays are bordered by cracks when dry, causing root stretching and constriction. As a result grasses with fine, spreading root systems cannot grow on Dense Clays. Summer showers are less beneficial for clay soils than silt soils because of : (1) less available water storage, (2) greater runoff loss and (3) lower wettability. (Casey-Arizona)
W71-01295

ANISOTROPIC PERMEABILITY IN POROUS MEDIA,
Syracuse Univ., N.Y.
Philip A. Rice, Daniel J. Fontugne, and Raimondo G. Latini.
Industrial and Engineering Chemistry, Vol 62, No 6, p 23-31, June 1970. 9 p, 7 fig, 2 tab, 36 ref.

Descriptors: *Porous media, *Permeability, *Anisotropy, Permeameters, Soil mechanics, Resistivity, Measurement, Mathematical analysis, Soils, Experimental data, Soil water movement, Laboratory tests, Methodology, Flow rates, Hydraulic conductivity, Percolation, Bibliographies, Field tests, Flow, Apparatus.
Identifiers: *Porous media flow, *Permeability tests, In situ tests, Soil resistivity.

Methods of measuring directional permeabilities in anisotropic porous beds are reviewed for consolidated and unconsolidated media. Anisotropic permeability data on consolidated beds and unconsolidated beds are summarized, and the relationships among the bed formation process, the bed structure, and the observed anisotropic permeabilities are discussed. Anisotropy is generally a result of the orientation and shape of the asymmetric grains making up the porous bed. Measurements indicate that the extent of anisotropy can be approximately predicted by measurements of resistivity in different directions. Several methods for predicting the potential and stream functions in anisotropic porous media are cataloged. (USBR)
W71-01387

WATER PERMEABILITY OF FROZEN SAND,
Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
V. D. Komarov.
Translated from Russian. Available from NTIS as AD-701 177, $3.00 in paper copy, $0.95 in microfiche. Also available as TT-61-19831. Trans. of Materialy po Laboratornym Issledovaniiam Merzlykh Gruntov, Vol 3, p 142-148, 1957. U.S. Army Snow Ice and Permafrost Research Establ. Translation 66, January 1961. 5 p.
Identifiers: *Soils, Moisture, Freezing, Temperature, Absorption, Sand, Test methods, USSR Translations, *Frozen soils, Groundwater.

The total mount of water and ice in frozen sand several hours after the test always remained considerably higher than the capillary moisture capacity of unfrozen sand. This is not without interest because one can easily imagine a process of considerable supersaturation of frozen sand as a result of alternating freezing and thawing.
W71-01505

WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION FOR APPLICATION TO STUDY OF UNSATURATED FLOW OF SOIL WATER,
Washington State Univ., Pullman. Dept. of Agronomy.
Gordon L. Stewart, and Walter H. Gardner.
Available from NTIS as RLO 1543-5, $3.00 paper copy, $0.95 in microfiche. Project 1543 report, 1969. 26 p, 1 tab, 8 fig, 5 ref. AEC AT (45-1) 1543.

Descriptors: *Soils, Moisture, *Hydrology, Neutron reactions, Thermal neutrons, Neutron cross sections, Non-destructive testing, Nuclear industrial applications.
Identifiers: Moisture content, *Groundwater.

Adequate testing of the applicability of various equations to studies of unsaturated water flow in soil requires a precise method for water content measurement. A neutron-matter interaction technique has been developed in this investigation to measure water contents of small volume elements of soil accurately, rapidly, and at frequent time intervals. This method can be used to measure water content in many types of experiments but it is particularly well suited for experiments involving transient flow. High thermal neutron fluxes, available at the present time only from nuclear reactors are required. The method is superior to existing methods for measuring, non-destructively, water content as a function of time and position. The inherent precision due to the random nature of neutron production with a neutron count in dry soil of 6 x 100,000 c/m. for 2 second counting and a resolution of 1 mm. by 1 cm. for dry and wet water content regions (about 5% and 40% water) are about plus or minus 0.2% and plus or minus 0.4% water. For 30 second counting times the precision improve to about plus or minus 0.05% and plus or minus 0.1% water. Longer counting times would lead to further improvement. Neutron attenuation is not seriously affected by density changes but soil bulk density can be measured by use of long counting times. Precision for soil bulk density measu

ment is about plus or minus 0.002 gm./cc with counting times of about 200 seconds. With improved techniques and fluxes available at a 100 kw reactor it appears possible to improve the present resolution by a factor of 10 beyond that reported here.
W71-01524

HYDRAULICS OF LOW-GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Natural Resources Center.
Norman A. Evans, Dale F. Heerman, Orlando W. Howe, and Dennis C. Kincaid.
Available from NTIS as PB-195 784, $3.00 in paper copy, $0.95 in microfiche. Colorado State University Environmental Resources Center Completion Report, June 30, 1970. 55 p, 19 fig, 5 tab, 18 ref. OWRR Project No B-024-COLO (1).

Descriptors: *Irrigation systems, *Border irrigation, *Soil water movement, *Hydraulics, Surface irrigation, Infiltration, Soil tests, Infiltrometers, Retardance, Soil density, Soil water, Clay loam, Resistivity, Storage capacity, Water balance, Analysis, Equations, Hydrographs, Mathematical models, Unsteady flow.
Identifiers: Hydrodynamic model, Dimensionless curves.

Surface flow data from field experiements on 21 borders were analyzed to determine parameters characterizing infiltration and surface retardance. Infiltration constants for a logarithmic intake function were determined by the use of cylinder infiltrometers and by using the entire border as an infiltrometer. The borders were constructed on a clay loam soil which exhibited cracking when dry. The infiltration analysis showed that for this type of soil, the cylinder infiltrometers underestimate the infiltrated depth by nearly 50 percent. Resistance parameters were calculated by a volume balance procedure after the intake constants were determined. A mathematical model simulating border irrigation was developed by using the theory of unsteady hydrodynamics. The momentum and continuity equations were solved numberically by the method of characteristics. The advance of the wetting front was controlled by the requirement that the sum of the surface storage and infiltrated volumes must equal the total volume applied at all times. Dimensionless curves were derived relating the average surface storage depth to the advance distance. (Woodard-USGS)
W71-01545

2H. Lakes

RESERVOIR RIM STABILITY - LAKE ROOSEVELT. COLUMBIA BASIN PROJECT.
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08E.
W71-01154

LIMNOLOGY STUDIES, AMCHITKA ISLAND, ALASKA,
Battelle Memorial Inst., Columbus, Ohio.
Jerry D. Koob.
Available from NTIS as BMI-171-124, $3.00 in paper copy, $0.95 in microfiche. August 1969, various paging, Annual Progress report, FY 1969. Amchitka Bioenvironmental Program. Contract AT(26-1)-171.
Identifiers: *Alaska, Lakes, *Lakes, Chemistry, pH, Chlorides, Aleutian Islands, *Limnology, Amchitka Island, Dissolved organic matter.

The limnological survey that was initiated in Fiscal Year 1968 was expanded to include an additional 5 lakes and ponds on the northwestern third of Amchitka. All lakes and ponds were differentiated into three groups on the basis of alkalinity and altitude. The Aleut Point Peninsula group was highly similar to the group of lakes in the Rifle Range region near Site B with respect to pH, alkalinity, and chloride concentration. The high-altitude group (above 475 feet) was characterized by low alkalinity, low chloride, and pH's near 7. One lake in this group was biologically unique in that it contained large populations of fairy shrimp and red copepods. The concentrations of total organic matter were measured in 42 lakes and ponds on Amchitka, 25 of which are located on the northwestern third of the island. Most of the northwestern lakes contained less than 10 mg/l total organic matter, while the 17 southeastern ones generally contained more than this amount. The ratios of dissolved to particulate organic matter, along with rates of primary productivity and heterotrophic uptakes of acetate were measured for lakes between Site F and the main Atomic Energy Commission (AEC) camp. The concentrations of dissolved organic matter were characteristically much higher than the suspended particulate organic matter, except in acid, low-alkalinity lakes. In only two of the ten lakes sampled was the allochthonous organic matter considered to be of more importance than the autochthonous matter. Primary productivities were measured in the autumn and again in the spring. Of the eight lakes regularly sampled, five were productive and three were unproductive. Extremely high dark fixation rates occurred in the productive alkaline lakes near Site B. A test for alkaline phosphate activity supported the observation from FY 1968 that phosphate was limiting to primary productivity in may of the lakes of Amchitka. A comparison of correlations between various biological phenomena suggests that, of the eight lakes regularly sampled, three were productive and stable and three were unproductive and stable; the remaining two were productive but unpredictable with respect to correlations among primary productivity, heterotrophy, and concentration of organic matter.
W71-01160

THE SLOPE OF LAKE SURFACES UNDER VARIABLE WIND STRESSES,
Corps of Engineers, Washington, D.C. Beach Erosion Board.
B. Haurwitz.
Available from NTIS as AD-699 402, $3.00 in paper copy, $0.95 in microfiche. Technical Memorandum No 25, November 1951. 23 p.
Identifiers: *Lake waves, Wind, Tropical cyclones, Surfaces, Florida, Beaches, Erosion, Lake Okeechobee, Beach erosion, Seiches, Air water interactions.

The inclination of a lake surface caused by a wind stress shows a distinct time lag in adjusting itself to changing winds. To analyze this phenomenon use is made of the hydrodynamic equations which are simplified by integrating over the whole depth of the lake. It is found that the time required by the lake to respond to changing wind stresses depends on the length of the seiche periods. Particular attention is given to the case of a wind which changes its direction. Such a wind shift took place during the passage of the hurricane of 26-27 August 1949, over Lake Okeechobee, Florida, when the wind turned through about 180 degrees during a time of roughly three hours. This turning of the wind was accompanied by a turning of the height contours of the lake surface, but the latter rotated more slowly than the wind direction so that for some time the wind blew parallel rather than perpendicular to the isohypses. It is shown that the theory explains this behavior of the lake surface.
W71-01183

CHANGES IN WATER ENVIRONMENT RESULTING FROM AQUATIC PLANT CONTROL,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 04A.
W71-01196

PROCESSING CHARACTERISTICS OF SUBSURFACE MACROPHYTES OF MADISON, WISCONSIN LAKES IN RELATION TO MECHANICAL HARVESTING SYSTEMS,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 04A.
W71-01197

METHODS OF CALCULATING STEADY AND UNSTEADY CURRENTS IN HOMOGENEOUS LAKES,
Cornell Univ., Ithaca, N.Y.
James A. Liggett.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 103-112, 1969. 10 p, 3 fig.

Descriptors: *Waves (Water), *Water circulation, *Lakes, Storms, Winds, Fluid mechanics, Mathematical studies, Mathematical models, Currents (Water).
Identifiers: Lake circulation.

Three methods for computing wind-driven lake circulation are summarized. Each considers a shallow (large horizontal dimension compared to depth), homogeneous lake on a rotating earth. In each case the lake circulation is three-dimensional. The wind stress functions are specified in the boundary conditions and no hypothesis is made concerning the surface phenomena. The first method is a steady-state, linear theory with horizontal diffusion of momentum neglected. The second adds the time derivative to the equations in order to compute unsteady flow. The third method considers all terms of the equations of motion. As the equations become more complex, more of the solution must be carried out numerically. Finally, an example of a storm passage over a lake which is initially at rest is presented. (Knapp-USGS)
W71-01244

PHYSICOCHEMICAL CONDITIONS OF DEPOSITION OF BACILLARIOPHYTA IN DAVIS LAKE, KLAMATH AND DESCHUTES COUNTIES, OREGON, U.S.A.,
Northeast Louisiana State Coll., Monroe. Dept. of Biology.
S. Messina-Allen, and Sam L. Van Landingham.
Hydrobiologia, Vol 35, No 1, p 31-44, 15 June 1970. 2 fig, 2 tab, 43 ref.

Descriptors: *Diatoms, *Deposition (Sediments), *Physiocochemical properties, *Lake stages, Lake soils, Semiarid climates, Oregon, Aquatic microorganisms, Lava, Seepage, Ecology, On-site data collections, Plankton, Hydrogen ion concentration, Lakes.
Identifiers: *Bacillariophyta, Fossil diatoms.

The collection of fossil diatoms enables a determination of their probable environment of deposition on the assumption that the physicochemical environment of a modern taxon was also characteristics of fossil forms of the same taxon. Davis Lake lies on the semiarid eastern slope of the Oregon Cascade Range in an area that is slowly drying up. Since outflow is by seepage through associated lava formations, the lake was probably formed by lava blockage of stream flow. Diatom deposits were collected, analyzed and compared with data from other lakes. The population consisted of both planktonic and non-planktonic forms. The inferred deposition conditions were: (1) Alkaliphilous, in contrast to many western Cascade lakes, (2) oligohalobous (indifferent), (3) oligosaprobic and (4) eutrophic. Current conditions are limnobiontic to indifferent. Probably deposition occurred in a bog or swale which served as a runoff basin for volcanic uplands. (Casey-Arizona)
W71-01288

AGRICULTURAL CONTRIBUTION TO THE EUTROPHICATION PROCESS IN BEAVER RESERVOIR,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
R. A. Gearheart.
For presentation at the 1969 Winter Meeting American Society of Agricultural Engineers, Chicago, Illinois, Dec 9-12, 1969. American Society of Agricultural Engineers, Paper No 69-708, 1969. 21 p, 6 fig, 2 tab, 22 ref. OWRR Project B-012-ARK (3).

Descriptors: *Eutrophication, *Reservoirs, Nitrogen, Phosphorus, Runoff, Domestic wastes, Rainfall, Agricultural watersheds.
Identifiers: *Beaver Reservoir (Ark), White River, Fayetteville (Ark).

A study of eutrophication of the Beaver Reservoir (Arkansas), disclosed that the major contribution of nitrogen and phosphorus was provided by runoff from farm lands occupying a watershed of some 900 square miles. The total nitrogen and total phosphorus from this source averaged annually 3.2 and 2.1 lb/acre, respectively. The contribution of domestic waste effluent was considerably reduced by the recent installation of treatment facilities. Yet, the City of Fayetteville's annual production of domestic waste totals 14 lb of nitrogen and 4.1 lb of phosphorus per capita of its 30,000 population. The urban runoff added on the average 5% of total nitrogen and 2% of total phorphorus. The addition of nitrogen by rainfall approximated 8%. (Wilde-Wisconsin)
W71-01375

EUTROPHICATION-TROPHIC STATE RELATIONSHIPS IN NORTH AND CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville.
Earl E. Shannon.
Doctoral dissertation for PhD, University of Florida, 1970. 256 p, 11 fig, 34 tab, 274 ref, 3 append. OWRR Project B-004-FLA (1).

Descriptors: *Trophic level, *Lakes, *Eutrophication, *Florida, Biomass, Primary productivity, Nutrients, Dissolved solids, Conductivity, Indicators, Dissolved oxygen, Sediments, Water pollution sources, Water pollution effects, Mathematical models, Model studies, Statistical models, Sampling, Analytical techniques, Regression analysis.
Identifiers: Transparency, Trophic state indicators, Trophic state index, Trophic state classification, Canonical correlation, Cation ratios.

The relationships between trophic state of lakes and eutrophication factors were examined using multivariate statistical techniques. The analytical data were derived from 55 Florida lakes. A trophic state index (TSI) incorporated 7 indicators: primary production, chlorophyll a, total nitrogen and phosphorus, transparency, conductance and cation ratio. A positive correlation was established between trophic state, lake basin population, and land use. Regression and canonical analyses indicated that the most influential eutrophication contributors are heavy fertilization and lake shore residences without sewer facilities. (Wilde-Wisconsin)
W71-01378

STUDIES ON THE EFFECTS OF ABNORMALLY HIGH WATER LEVELS ON THE ECOLOGY OF FISH IN CERTAIN SHALLOW REGIONS OF LAKE VICTORIA,
East African Freshwater Fisheries Research Organization, Jinja (Uganda).
R. L. Welcomme.
Journal of Zoology, London, Vol 160, No 4, p 405-436, April 1970. 9 fig, 17 tab, 32 ref.

Descriptors: *Freshwater fish, *Lake stages, *Lagoons, *Ecology, *Water levels, Environmental effects, Habitats, Ecosystems, Animal metabolism, Fish behavior, Fisheries, Semiarid climates, Fish barriers, Fish populations, Fish establishment, Fish migration, Floating plants, Water temperature, Flooding, Oxygen, Vegetation establishment.
Identifiers: *East Africa, *Cichlid fish, *Lake Victoria, *Species diversity, *Deoxygenated waters.

Since 1961 water levels at Lake Victoria have been at record-breaking highs. Unstable, vegetation-choked, isolated and semi-isolated lagoons not usually present have appeared at varying distances from the main body of the lake. The fish populations of these isolated lagoons were studied and compared to those of the lake. Shortly after their formation the lagoons were colonized by various species of introduced cichlid genera. Species composition depended on the degree of isolation from the lake. In the more isolated lagoons only 2 colonizers were present, Tilapia leucosticta and Haplochromis nubilus. The factors accounting for this are deoxygenated water conditions under the floating vegetation, making extensive movement hazardous, and near lethal temperature levels. Isolated populations of the 2 species showed a conspicuous stunting phenomenon which often also occurs in fish ponds. This is due to a number of factors such as the buildup of inhibitory metabolites. The floating vegetational mats with their associated deoxygenated waters apparently act as biological filters. Studies of this type will result in improvements in managed fish production in the lake. (Casey-Arizona)
W71-01394

BEHAVIORAL AND PHYSIOLOGICAL RESPONSES TO TEMPERATURE IN THE DESERT PUPFISH CYPRINODON MACULARIUS,
Arizona Univ., Tucson; and Western Washington State Coll., Bellingham.
Charles H. Lowe, and Wallace G. Heath.
Supported in part by the Rockefeller Foundation, the University of Arizona and the U.S. National Park Service. Physiological Zoology, Vol 42, No 1, p 53-59, January 1969. 3 fig, 2 tab, 15 ref.

Descriptors: *Fish behavior, *Arid lands, *Water temperature, *Heat resistance, *Physiological ecology, Laboratory tests, On-site investigations, Thermophilic animals, Animal physiology, Arizona, California, Ecology, Animal behavior, Habitats, Southwest U.S., Acclimatization, Thermal stress, Seasonal, Winter, Summer, Ponds, Deserts, Fluctuation, Temperature, Microenvironment.
Identifiers: *Critical thermal maximum, *Desert waters, *Desert pupfish, Thermoregulation, Sonoran Desert, Organ Pipe Cactus National Monument, Survival.

The desert pupfish inhabits shallow southwestern desert ponds which undergo wide daily and annual temperature fluctuations. Laboratory and field investigations were undertaken to determine the critical thermal maxima (CTM) of these fish and the mechanisms whereby they survive high water temperatures. The maximum CTM is 44.6 degrees C. in Arizona, apparently the highest yet recorded for fish. Summer and winter CTMs are quite different and seasonal acclimation determines survival capabilities since winter seasonal acclimated pupfish would die in several areas of their natural summer thermal environment in Arizona. Behavioral thermoregulation is a critical survival mechanism and younger fish select warmer thermal microenvironments than adult fish of the same population. Behavioral thermoregulation at temperatures near the CTM is common. Behavioral thermoregulation is an early phylogenetic development in vertegrates. (Casey-Arizona)
W71-01395

THE MEROMIXIS OF SUNFISH LAKE, SOUTHERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Biology.
Hamish C. Duthie, and John C. H. Carter.
Journal Fisheries Research Board of Canada, Vol 27, No 5, p 847-856, 1970. 5 fig, 1 tab, 16 ref.

Descriptors: *Meromixis, *Phytoplankton, *Circulation, Seasonal, Epilimnion, Cycling nutrients, Oxygen, Dissolved solids, Subsurface waters, Springs, Algae, Geology, Hemlock trees, Chara, Sulfides, Depth, Hydrography, Temperature, Dissolved oxygen, Hydrogen ion concentration, Alkalinity, Phosphates, Nitrates, Ice, Sediments, Stratification, Chemical analysis, Sulfates.
Identifiers: *Sunfish Lake (Ontario), Metalimnion, Oscillatoria agardhii, Monimolimnion, Mixolimnion, Blooms.

In a meromictic lake efficiency of exchang between mixolimnion and monimolimnion to great extent controls trophic level of the euphoti zone. In a permanently meromictic lake th monimolimnion acts as a nutrient trap, particularl if the importation of nutrients from the watershe is low and the lake is small, sheltered, and relativel deep, primary productivity will be low. This stud was undertaken to explain the occasional ap pearance of large algal blooms in upper waters meromictic Sunfish Lake, a small lake whos phytoplankton productivity is ordinarily low. Th periodic large phytoplankton populations were a sociated with circulation of the mixolimnion. Pe haps some organic dissimilation took place in lowe mixolimnion, recycling nutrients during spring an fall circulation. Phytoplankton was practically ab sent from the epilimnion in summer but a popula tion of Oscillatoria agardhii remained in th metalimnion, where it was responsible for pronounced and persistent metalimnetic oxyge maximum. The monimolimnion contained abou 5100 milligrams/liter of dissolved solids and th upper mixolimnion about 2200 milligrams/lite Ventilation of the monimolimnion did not alway coincide with circulation and subsurface sprin may have been responsible. Circulation to lake bo tom was observed only once in 18 months. (Jone Wisconsin)
W71-01476

ONE OF THE QUANTITATIVE CHARAC TERISTICS OF THE STRUCTURE O PHYTOPLANKTONIC ASSOCIATIONS OF TH BRATSKII BASIN (IN RUSSIAN),
O. M. Kozhova.
Doklady Academii nauk SSSR, Vol 187, No 5, 1165-1168, 1969. 1 fig, 2 tab, 6 ref.

Descriptors: *Phytoplankton, *Productivity, Diu nal, Biomass, Phosphorus, Oxygen, Seasonal, Ca bon, Algae.
Identifiers: Phosphorus-biomass ratio, Biotic dive sity, Lake Baikal.

The productive potential of phytoplankton in th Bratskii retention basin was appraised on the bas of the P/B ratio, where P (phosphorus) is the tot diurnal production determined by the oxyg method, and B is the biomass of the phytoplankto Both values were obtained simultaneously and r calculated to carbon at the ratio C — 10% of th fresh weight of algae. The P/B ratio failed to be si nificantly correlated with the Margalev's index biotic diversity (r — 0.24). The coefficient P varied during the time of investigations from ze to 8.2 with the arithmetic average of 1.6. The latt value can be considered as characteristic for t Bratskii basin after its 3 years of existence. (Wild Wisconsin)
W71-01485

USE OF TRITIUM TO STUDY WATER DYNA ICS OF LEMAN (LAKE GENEVA) (FRENCH),
Pierre Hubert, Michel Meybeck, and Philippe Olive.
Comptes Rendus Academie des Sciences, Par Vol 270, Serie D, p 1298-1301, 1970. 3 fig, 1 tab ref.

Descriptors: *Lakes, *Dynamics, *Tracers, Tri um, Physicochemical properties, Floods, Rive Precipitation (Atmospheric).
Identifiers: Lake Geneva, Dynamic pattern Chronological pattern, Rhine River, Strata.

Within the capacity of isotope tracers, tritium permitted to differentiate water masses of different physicochemical composition. Moreover, the tracer provided a chronological pattern of dynamic changes of the lake. The Lake Geneva exhibits 3 more-or-less pronounced strata of different dynamic behavior: the surface 0-50 meter layer affected by thermal convection; the intermediate layer, from 50 to 150 meter depth, playing the most important part in the renovation of water; the deep layer, below 150 meters, presenting the realm of great inertia. The 5-year study of the central part of the lake revealed a persistent enrichment of its content, at an approximate depth of 100 meters, by waters from the preceding year floods of the River Rhone. (Wilde-Wisconsin)
W71-01490

EXPERIMENTAL EVIDENCE OF CHEMICAL WEED ERADICATION IN LAKE TRASIMENO (IN ITALIAN),
Perugia Univ. (Italy). Inst. of Hydrology and Fish Culture.
Giampaolo Moretti, Livio Zinnai, and Carlo Antonelli.
English summary. Rivista di Idrobiologia, Vol 1, No 2-3, p 95-114, 1962.

Descriptors: *Herbicides, *Lakes, Aquatic plant control, Chemcontrol, Physical control, Inhibitors.
Identifiers: Phragmites communis, Lake Trasimeno (Italy), N P herbicide.

The dense cover of Phragmites communis in and around Lake Trasimeno, Umbria (Italy), was successfully eradicated by the herbicide N P, comprised of 60% sodium dichlorobutyric acid and 40% chlorinated fatty acids. The compound was used only once during the period July to September. Approximately 30 kg of the N P in 10 to 15 hectoliters of water per hectare were sprayed evenly on aerial parts of plants. The treatment arrests the formation of chlorophyll and devitablizes the rhizomes. A combination of the chemical and mechanical eradication provided a particularly effective rapid, and inexpensive control of the undesirable hydrophytes. (Wilde-Wisconsin)
W71-01493

AN IMPLEMENT FOR TAKING LARGE UNDISTURBED CORE SAMPLES FROM LAKE SEDIMENTS (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
Heinz Ambuhl.
English summary. Schweizerische Zeitschrift fur Hydrologie, Vol 31, No 1, p 132-140, 1969. 8 fig, 4 ref.

Descriptors: *Instrumentation, *Cores, Sediments, Sampling, Lakes.
Identifiers: Deep lake core sampling.

The described device for collection of sediment core samples from deep lakes consists of a cylinder having a 112-millimeter interior diameter. Loss of sampled material is precluded by a closing mechanism. The separation of an undisturbed core sample from the closing mechanism is accomplished by a blade on a special cutting table. (Wilde-Wisconsin)
W71-01494

DETERMINATION OF ASSIMILABILITY OF ALGAE, YEASTS, AND BACTERIA BY CERTAIN REPRESENTATIVES OF CLADOCERA (IN RUSSIAN),
V. K. Fedorov, and Yu I. Sorokin.
Doklady Akademii nauk SSSR, Vol 174, No 4, p 969-970, 1967. 1 tab, 5 ref.

Descriptors: *Foods, *Radioactive techniques, Crustaceans, Aquatic populations, Daphnia, Tracking techniques, Algae, Yeasts, Bacteria, Laboratory tests, Plankton.
Identifiers: C-14 analysis, Food assimilation, Simocephalus vetulus.

The difficult task of determining food assimilation is considerably simplified by the use of C-14 analysis. The objects of this study--Daphnia longispina and Simocephalus vetulus--were fed by bacteria, pink yeasts, and alga Chlorella. Bacteria and yeasts were labeled by their cultivation in the medium of C-14 glucose; the algae, in a medium with radioactive carbonate. Following a period of adaptation, 50 to 100 crustaceans were placed for 20 minutes in a vessel with water containing 10 to 15 mg/liter of food organisms. At the beginning and at the end of trials, samples of water were passed through a membrane filter and the activity of the dried filtrates determined by a counter. The amount of food consumed by the crustaceans was calculated from the difference in readings taking into consideration the number of organisms and the reciprocal specific radioactivity or organic carbon of the food. The trials were duplicated in water adjusted to pH 8.2 and enriched with unlabelled food organisms. Daphnia assimilated yeasts better than other food sources. Simocephalus assimilated bacteria best, slightly less algae, and yeasts least efficiently. (Wilde-Wisconsin)
W71-01496

IMPORTANCE OF PROVISION WITH FOOD FOR THE SURVIVAL OF FISH LARVAE (ON AN EXAMPLE OF THE BREAM OF RYBINSK RESERVOIR),
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
D. A. Panov.
Available from NTIS as PB-189 894T, $3.00 in paper copy, $0.95 in microfiche. Translated from Biologiya I Troficheskie Svyazi Presnovodnykh Bespozvonochnykh i Ryb. Sbornik Statei. Akademiya nauk SSR, Institut Biologii Vnutrennikh Vod, Trudy, No 17 (20), 'NA', Leningrad, 1968, p 199-221. Russian translation by Narragansett Marine Game Fish Research Lab, June 1969. 32 p.
Identifiers: Food chains, *Fishes, Larvae, *Larvae, Food, *Lakes, Fishes, Nutrition, Population, Ecology, Acclimatization, Nutrition, Marine biology, USSR.

The fish productivity of the majority of existing reservoirs is very low. By 3-4 times, and sometimes even more, it yields to the fish productivity of lakes situated in identical climatic zones. One of the first steps taken to increase the fish productivity of reservoirs was acclimatization of new species of fish. It was considered that since waters of a new type with new conditions are created, then the old river forms of fish cannot fully accept all of the ecological niches in them. For a number of reasons, including the low food abundance of reservoirs, this measure proved to be rather ineffective. It yielded no substantial positive results nor did the acclimatization of invertebrates. Radical improvement of the food base can be attained only through fertilization of the reservoir, which lead to improvemenent of feeding conditions for the invertebrates. The data presented permit one to consider that increase of the food base for larvae, especially at early stages of development, can bring about increase of the yield of young in Rybinsk Reservoir, and consequently also increase of the abundance of fish generations and the whole stock.
W71-01506

ACOUSTIC TECHNIQUES OF FISH POPULATION ESTIMATION WITH SPECIAL REFERENCE TO ECHO INTEGRATION,
Washington Univ., Seattle. Fisheries Research Inst.
Richard E. Thorne, and Henry W. Lahore.
Available from NTIS as PB-190 388, $3.00 in paper copy, $0.95 in microfiche. Circular No 69-10, September 22, 1969. 12 p, 6 fig, 17 ref. NSF Grant GH-40.
Identifiers: Fish surveys, Echo integrators, Merluccius products, Clupea harengus, Onchorhynchus merka.

An effort was made to develop a system that could be used to enumerate both adult and juvenile salmon. The schooling habits of these fish preclude a direct enumeration of individual fish, and the effort was centered on an estimate of the biomass of fish through integration of the reflected echosignals. These, in turn, must be converted into population estimates by a test-fishing program. The report contains a brief description of the developed integrator and the calibration experiments on stocks of hake and herring in Puget Sound.
W71-01508

ECOLOGICAL-PHYSIOLOGICAL PECULIARITIES OF CERTAIN SPECIES OF FISH,
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
P. A. Korzhuev.
Available from NTIS as PB-189 898T, $3.00 in paper copy, $0.95 in microfiche. Translated from Trudy Soveshchanti Ikhtiol. Komis. Akad. nauk SSSR, 1958. 8: 364-371. Russian translation by Narragansett Marine Game Fish Research Lab., November 1969. 9 p, 3 tab, 6 ref.
Identifiers: *Fishes, *Physiology, *Ecology, Fishes, Environment, Blood, Hemoglobin, Erythrocytes, Body weight, Oxygen, Morphology (Biology), Adaptation (Physiology), Musculoskeletal system, Skin, Blood circulation, Respiration.

Different oxygen concentration in water, which is determined by a number of conditions, is a very important factor which influences the distribution of various aquatic organisms, and especially fish, as the most active representatives of aquatic animals. The adaptation of fish to some or other conditions of existence naturally is specified not only by their relationship to oxygen, but also the possibility of accomplishment of such vital functions as feeding and reproduction. Nevertheless, the accomplishment of these functions becomes possible only with steady provision of the organism with oxygen. For this reason, considerable interext is generated by study of the physiological mechanisms which supply the organism with oxygen under different conditions of existence. Such study permits understanding of the reason for the different relationship of different fishes to one or another regime, for in this the concrete forms of the connection of the organism and the environment are revealed. Only in a plan wherein concrete investigations are formed in accordance with the principle of unity of the organism and the environment, with consideration of the peculiarities of the environment, can the most important sides of the connections between the organism and environment be revealed.
W71-01510

ON THE SOARING OF NON-MOTILE PLANKTONIC ALGAE,
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
A. P. Skabichevskii.
Available from NTIS as PB-189 893T, $3.00 in paper copy, $0.95 in microfiche. Tranlated from Uspekhi Sovremennoi Biologii, Vol 26, No 1 (4), 1948, p 615-618. Russian translation by Nerragansett Marine Game Fish Research Lab., June 1969. 5 p, 10 ref.
Identifiers: *Plankton, Sedimentation, Adaption (Physiology), Density, Weight, Environment, Ecology, Algae, Water, Physiology, Gravity, Marine biology, USSR.

The entire life of planktonic organisms takes place in the water thickness, and the sole support of their body is the water mass. But water, as is well known, is not so dense a medium that even insignificant bodies could be retained in it. Sooner or later suspended matter must precipitate to sediment, if, of course, the suspended bodies are heavier than water. In the process of natural selection in planktonic organisms, adaptations were produced which enabled their support in the water thickness. Such adaptations include organs of active movement, decrease of the body weight through the development of light-weight assimilators, thinning down of

the cell wall, and the formation of gas vacuoles. Finally, there are also very diverse parachute adaptations which lead to increase of the total body surface. To them belong the flat- or needle-like body shape of many unicellular organisms, the formation of flat, stellate, filamentous colonies, the secretion of slime, etc. However, despite all of these adaptations the absolute weight of plankters remains considerable and for the most part in excess of the weight of water. Calculation of this, and also the conditions of the environment permitted Ostwald in 1902 to express a theory of soaring of planktonic organisms, according to which their residence in a suspended state is descent at a minimal rate. The rate of sinking, according to Ostwald, is proportional to the residual weight, and inversely proportional to the form of resistance and to the viscosity of the water. Ostwald presented this position in the form of his well-known formula: a—b/c (d) where a - is the rate of sinking, b - is the residual weight of the plankton, c - is the form of resistance, d - is the internal resistance (viscosity) of the water.
W71-01511

NUMERICAL CALCULATIONS OF THE STEADY-STATE, WIND-DRIVEN CURRENTS IN LAKE ERIE,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
Richard Gedney, and Wilbert Lick.
Available from NTIS as N70-26980, $3.00 in paper copy, $0.95 in microfiche. Thirteenth Conference on Great Lakes Research, Buffalo, N.Y., March 31-April 3, 1970. Typescript, 12 p, fig. NASA TMX-52786.
Identifiers: *Conferences, Fluid flow, *Lakes, *Mathematical models, *Wind effects, Currents.

Solutions for the steady-state, wind-driven currents in Lake Erie have been obtained by numerical methods. A shallow lake model, which does not require the friction layers to be small by comparison with the depth of the lake, has been used. In order to obtain some of the observed features of the currents, it was necessary to use a relatively small grid (3.22 kilometers). This grid was variable in size for the mesh points adjacent to the boundaries, thus permitting an accurate approximation of the boundary. The velocity as a function of depth and horizontal position has been determined. Results are presented for southwesterly and northeasterly winds. In both cases, narrow bands of strong currents were found near the shore. In other areas, large subsurface gyres were evident. The calculated results compare quire well with seabed drifter measurements and other observations.
W71-01517

AN ACT RELATING TO PERMITS FOR DREDGING AND ERECTION OF CAUSEWAYS, DOCKS, ETC. IN TRIBUTARIES OF GREAT PONDS.
For primary bibliographic entry see Field 06E.
W71-01554

2I. Water in Plants

SEASONAL PHENOMENA IN THE PLANKTON OF THE LABRADOR SHELF, THE GRAND BANK OFF NEWFOUNDLAND AND FLEMISH CAP,
Naval Oceanographic Office, Washington, D.C.
T. N. Semenova.
Transl. from Russian. Available from NTIS as AD-705 043, $3.00 in paper copy, $0.95 in microfiche. 1969, 22 p. Naval Oceanographic Office Trans 421.
Identifiers: *Plankton, Newfoundland (Province), Production, Statistical analysis, Counting methods, Classification, Atlantic Ocean, USSR, Translations, Labrador Shelf, Grand Banks, Flemish Cap, Northwest Atlantic Ocean, PINRO expedition.

The study is based on data collected by several PINRO expeditions in the spring-summer of 1960 and from the summer of 1961 to the summer of 1962 in the NW Atlantic. Data published by American researches have been utilized to present a comprehensive survey of plankton production on the Grand Bank, Flemish Cap and in surrounding areas. The numerical values and variations of zoo- and phytoplankton biomass with seasons and areas are given, singling out the major zooplankton species. In this connection the existence of various water types, their origins and movements, is brought into discussion. Some of the typical data are graphed and tabulated.
W71-01168

THE INFLUENCE OF INADEQUATE WATER SUPPLY ON METABOLISM IN BIOLOGICAL SYSTEMS WITH EMPHASIS ON PROTEIN SYNTHESIS AND NUCLEIC ACID METABOLISM,
Florida Univ., Gainesville. Water Resources Research Center.
S. H. West.
Available from NTIS as PB-195 666, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Publication No 9 of the Florida Water Resources Center, August 1970. 12 p, 14 ref. OWRR Project A-008-FLA (1).

Descriptors: *Water supply, *Water shortage, Water utilization, *Plant growth, Metabolism, *Droughts, *Water consumption (Plants), Soil moisture, Drainage.

Data have been obtained that show the effect of drought on growth itself and how this reduction in growth may be a result of specific changes in total protein production, nucleic acid metabolism and on functional activity of a fraction of nucleic acids. While the drought treatments decreased total protein by only 40%, growth was reduced 80%. These data suggested that the synthesis of growth-dependent proteins was being hindered. Although total nucleic acid production was not reduced by the lack of water, the function of the nucleic acid fraction responsible for delivering the genetic information to the process of protein synthesis was altered. This fraction of nucleic acid was not, under water-stress conditions, getting attached to ribosomes. This malfunction prevented the synthesis of a proline-rich protein which is probably required for cell wall production during growth. This information provides a specific selection criterion and should aid in the development of plants and perhaps other organisms that can withstand stress from drought.
W71-01191

SOIL WATER AND TREE GROWTH IN A GREAT PLAINS WINDBREAK,
Forest Service (USDA), Rlincoln, Neb., Rocky Mountain Forest and Range Experiment Station.
D. H. Sander.
Soil Science, 1970, Vol. 110, No 2, p. 128-135, 6 tab, 3 fig, 11 ref.

Descriptors: *Soil-water-plant relationships, *Plant growth, *Windbreaks, *Trees, *Soil water, Moisture content, Limiting factors, Great Plains, Growth rates, Snowmelt, Nebraska, Arid lands, Evapotranspiration, Water loss, Root systems, Soil profiles, Precipitation (Atmospheric), Soil water.
Identifiers: *Limiting tree growth, Snow accumulation.

Soil water is one of the most important factors limiting tree growth in the Great Plains. Soil water regime and tree growth in a 21-year old 10-row windbreak in eastern Nebraska were investigated. Soil water content was determined by the neutron-tube method to a depth of 11 feet, and tree diameter growth was recorded throughout 1960 to 1963. Soil water use was characterized by depletion from the surface soil early in the growing season and from deeper layers of the soil profile later in the season. Snow accumulation was a valuable water source for windbreak trees. There was a trend of reduced growth during the low moisture years. Stem basal area growth increased from current early season precipitation and soil water reserves from the upper 6 or 7 feet of soil. Windbreak trees in the Great Plains grow and survive primarily on current precipitation. Results suggest that soil water supply is adequate to establish trees where old rows have been removed in windbreaks in the eastern Plains. Included are tables and graphs of species, height, profile characteristics, water balance, recharge, loss and basal area increase. (Popkin-Arizona)
W71-01280

ORNAMENTALS FOR CALIFORNIA'S MIDDLE ELEVATION DESERTS,
California Univ., Davis. Div. of Agricultural Sciences.
Mildred E. Mathias, W. Metcalf, M. H. Kimball, C. L. Genistreet, and D. E. Gilbert.
California Agricultural Experiment Station, Bulletin 839, March 1968. 44 p, 7 fig, 4 tab, 1 map (fold-out in pocket).

Descriptors: *Ornamentals, *California, *Desert plants, *Ecological distribution, Arid lands, Biogeography, Environmental effects, Climatology, Deserts, Drought tolerance, Climatic data, Planting management, Temperature, Trees, Shrubs, Great Basin.
Identifiers: *Middle Elevation Desert, *Elevation-controlled desert, *Plantclimates, Colorado Desert, Death Valley, Great Basin Desert, Mojave Desert, Plant communities.

California's 3 deserts occupy 37% of the state and lie east of mountainous barriers to moist Pacific air. They are in Plantclimate V and include the High Elevation Desert (Great Basin Desert), the Low Elevation Desert (Colorado Desert, Death Valley) and the Middle Elevation Desert (MED). The MED with 38,800 sq. mi. and arid-warm temperate to sub-alpine climates is California's largest. It contains half of the Mojave Desert. Fruit and nut growing here depend on winter temperature breaking dormancy, spring and fall frost, summer temperature, thermal belts, eposures and shelters. Control for plant selection are water supply and quality, soils and management. Climatic factors are two kinds of cold (normal seasonal low and 50-y freeze), rainfall, sunshine, humidity, growing season, wind and windbreaks. Native ornamental plants depend on water needs, drought and climatic-extreme tolerancy. A table presents temperature data in plantclimate subzones. A list of 380 plants known to grow satisfactorily is scored t 3 grades of drought tolerancy. Figures of temperature zones, rainfall distribution, plantclimate sub zones and elevation-controlled desert boundaries are included. There is a 12-item glossary. (Popkin Arizona)
W71-01281

A COMPARATIVE STUDY OF THE INTEGU MENT OF THE CAMEL, DORCAS GAZELL AND JERBOA IN RELATION TO DESER LIFE,
Khartoum Univ. (Sudan). Dept. of Zoology.
Laurice I. Ghobrial.
Journal of Zoology, London, Vol 160, No 3, p 50 521. 4 fig, 3 tab, 9 ref.

Descriptors: *Arid lands, *Xerophilic animal *Evaporation, *Water conservation, *Swea Water balance, Mammals, Transpiratio Epidermis, Animal physiology, Mode of actio Physiological ecology, Animal groupings, Ten perature, Cooling, Water loss.
Identifiers: *Integument, *Histology, *Camel *Gazelles, *Jerboas, Apocrine sweat gland Sebaceous glands, Hair, Sudan.

Physiological water conservation mechanisms desert animals other than man have been little st died. Comparative histological studies were ma on 3 animals in an effort to relate morphology arid area survival. Tubular-type sweat glands we present in both the gazelle and camel. They we

spread singly over the body surface in the gazelle and occurred in groups under clusters of hairs in the camel. Because of surface area/volume ratio problems, the jerboa probably cannot afford to perspire. Both the unkeratinized epidermis and horny layers were thin in the gazelle and jerboa. In dry air these relatively thin epidermal coverings may permit some water loss by transpiration. The gazelle has 2 types of hair -- long and short. Both types occur singly and are associated with sebaceous glands. They may be raised and a humid air layer may occur, leading to cooling even though evaporation is reduced. (Casey-Arizona)
W71-01285

WATER AND ELECTROLYTE BALANCE OF THE DESERT IGUANA, DIPSOSAURUS DORSALIS, IN ITS NATURAL HABITAT,
Michigan Univ., Ann Arbor. Dept. of Zoology.
John E. Minnich.
NSF Grant GB-2447. Comparative and Biochemical Physiology, Vol 35, No 4, p 921-933, 15 August 1970. 2 tab, 34 ref.

Descriptors: *Xerophilic animals, *Urine, *Electrolytes, *Water balance, *Salt balance, Cloaca (Zoological), Animal metabolism, Animal physiology, Reptiles, Data collections, Circulation (Animals), Mode of action, Moisture stress, Physiological ecology, Osmotic pressure, Arid lands, Water loss, Hydrogren ion concentration.
Identifiers: *Lizards, *Body fluid volumes, *Urate salts, *Desert iguana, *Excretion, Salt gland, Kidney.

Desert animals make very economical use of the little moisture available to them. The water intake of the desert iguana has a much higher salt content than its body fluids, but the animal is incapable of secreting a urine hyperosmotic to its blood nor does the salt gland appear functionally important in maintenance of salt balance. Plasma, extracellular and intracellular fluid volumes and electrolyte concentrations were measured in desert iguanas captured in different seasons. The animals were neither dehydrated nor did they exhibit tissue electrolyte accumulation. The distributions of body fluids in the various fluid compartments were directly proportional to the fat content of the animal. Both urinary and fecal salt concentrations varied with variations in dietary electrolytes. The principle method of maintaining salt balance seems to be through formation of relatively insoluble precipitated urinary K urate salts. This has the advantage of permitting the elimination of large quantities of ions with a relatively small water loss. Only a small quantity of water is produced by metabolism and a large proportion of water is lost in the feces. (Casey-Arizona)
W71-01286

FERTILIZATION OF THE GREGG VARIETY OF COTTON UNDER IRRIGATION AT THE NORTHEASTERN BRANCH STATION,
New Mexico State Univ., University Park; and New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01287

LEAFLESS EUPHORBIA ON RAJASTHAN ROCKS, INDIA: I. ECOLOGICAL LIFE-HISTORY,
Jodhpur Univ. (India). Dept. of Botany.
David N. Sen.
Folia Geobotanica et Phytotaxonomica, Vol 2, No 3, p 1-15, 1968. 23 ref.

Descriptors: *Life history studies, *Xerophytes, *Arid lands, *Leaves, *Moisture deficit, Germination, Ecology, Environmental effects, On-site investigations, Plants, Drought resistance, Growth stages, Habitats, Limiting factors, Longevity, Microenvironment, Mortality, Persistence, Phenology, Plant morphology, Population, Flowering, Seasonal, Photoperiodism, Temperature, Seeds, Ecotypes.
Identifiers: *India, *Rajasthan Desert, *Euphorbs, *Phylloclades, Seedlings.

The 'leafless' spurge (Euphorbia caducifolia) is a phyllocladic xerophyte of Indian deserts which: (1) grows on rocks and gravelly habitats, (2) does not compete with other plants, (3) flourishes in conditions of extreme heat and water deficit, (4) is spiny and unpalatable to animals, (5) grows slowly, (6) slowly propagates through seeds which do not undergo dormancy, (7) bears leaves only during acute summer heat and water deficits, (8) germinates only in conditions of optimum light and temperature (25-30 deg. C.), (9) flowers in January and February and disperses seeds in March and April and (10) is much disturbed by man for fuel. The morphology and life history of the plant are described in detail. In florescence color indicates the existence of 2 differing genetic populations and these give rise to a variety of intermediates. The existence of genetic differences is reinforced by consistent differences in germination times of differing strains under the same environmental conditions. (Casey-Arizona)
W71-01289

BIRDS OF A EUPHORBIA-ACACIA WOODLAND IN ETHIOPIA: HABITAT AND SEASONAL CHANGES,
Haile Sellassie I Univ., Addis Ababa (Ethiopia).
Edward W. Beals.
Journal of Animal Ecology, Vol 39, No 2, p 277-297, June 1970. 7 fig, 6 tab, 54 ref.

Descriptors: *Ecology, *Birds, *Vegetation, *Animal populations, *Rainfall, Climatic data, Trees, Shrubs, Animal behaviour, Xerophytes, Xerophilic animals, Semiarid climates, Tropical regions, Migratory birds, Non-migratory birds, Breeding, Nesting, Food habits, Competition, Environmental effects, Seasonal, On-site investigations, Plant groupings, Plant populations, Ecosystems, Habitats.
Identifiers: *Ethiopia, *Species diversity, *Thornscrub, Edge effect, Adaptability, Climbers.

The ecological dynamics of a species-rich tropical bird community were studied in a semiarid thorn woodland in Ethiopia. Trees, shrubs, subshrubs and climbers of the area were assayed for density and species richness. Heterogeneity was extremely high at the lucal level (100 square m.) providing for an 'edge effect'. There are 2 rainy seasons: a short one in April and a more extended period from June-October. Plants leaf and flower after the April rains and have another peak of flowering after the longer rains. Over 2 years, 102 species were observed and 37 of these nested in the area. The bird family and species diversities were characteristically high for tropical areas. Breeding densities were temporally staggered and were lowest during the rains and when transient non-breeding birds were present. It is tentatively concluded that the high bird species diversity may be explained by: (1) the patchy within-habitat plant species diversity created by shifts in intensity and time of rainy and dry seasons and (2) the relativelyhigh behavioral adaptability as shown by the staggering of breeding seasons in response to environmental changes. (Casey-Arizona)
W71-01292

PLANTING DATES FOR IRRIGATED GRAIN AND FORAGE SORGHUMS AT THE NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01293

MICROMETEOROLOGY AND ENERGY EXCHANGE IN TWO DESERT ARTHROPODS,
Arizona State Univ., Tempe. Dept. of Zoology.
Neil F. Hadley.
Ecology, Vol 51, No 3, p 434-444, Late Spring 1970. 8 fig, 27 ref.

Descriptors: *Microenvironment, *Micrometeorology, *Energy transfer, *Arid lands, *Xerophilic animals, Diurnal, Water loss, Variability, Deserts, Thermal capacity, Depth, Habitats, Data collections, On-site investigations, Ecology, Animal physiology, Burrows, Insects, Temperature, Solar radiation, Arizona, Albedo, Humidity, Evapotranspiration, Evaporation, Heat balance, Heat budget, Environmental effects, Mode of action, Moisture stress, Water balance, Climatic data, Animal behaviour, Convection.
Identifiers: *Arthropods, *Beetles, *Scorpions, *Subelytral cavity, Fossorial animals, Body temperature, Heat load, Thermocouples.

Surface climatic conditions were measured at an Arizona desert site and compared with arthropod burrow conditions at differing depths. Responses to climatic variations were also recorded in burrowed scorpions and surface beetles. High albedo, clear skies and high surface temperatures resulted in considerable reradiation of solar energy so that net radiation values are lower than those of many non-desert areas at the same latitude. When surface temperatures were compared with burrow temperatures it was found that when the surface was warm, 20-35 cm depths were cool, and vice-versa. Scorpion burrows at equal depths had daily relative humidity ranges of 55-70% while surface levels were less than 5%. Scorpions are able to escape both suboptimal high and low temperatures by vertical movement. The elytral temperatures of black beetles were measured at various surface temperatures. The animals were able to establish body thermal equilibria only under mild heat loads. Painting their dorsal surfaces slightly reduced elytral temperatures, but the significance of this is uncertain. Heat exchange budgets were calculated for the beetles and heat lost by convection equaled heat gained by radiation. The significance of the subelytral cavity in ventilation and water loss reduction is discussed. (Casey-Arizona)
W71-01294

ECOLOGICAL EFFECT OF A CLAY SOIL'S STRUCTURE ON SOME NATIVE GRASS ROOTS,
South Dakota State Univ., Brookings. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-01295

HELP FOR THE DESERT BIGHORN,
Utah Agricultural Experiment Station, Logan.
Lanny Wilson, Larry Farnsworth, and Lois M. Cox.
Utah Science, Vol 29, No 2, p 34-36, June 1968. 3 photo.

Descriptors: *Sheep, *Water shortage, *Wildlife management, *Utah, *Animal populations, Watershed management, Arid lands, Water requirements, Competition, Grazing, Hunting, Big game, Limiting factors, Nutrient requirements, Springs, Colorado River.
Identifiers: *Desert bighorn sheep, *Range population, *Mineral deficiencies, *Population limit, Watering sites, Wingate Mesa (Utah), Green River (Utah), Game animals.

The rugged canyon country of southeastern Utah still harbors some of the most prized game animals on the North American continent, but their numbers have been decreasing since a 1776 report. Today desert bighorn sheep are rare along the Green and Colorado Rivers because they were pushed off ranges by domestic stock, subjected to diseases, wantonly killed, hunted by uranium miners and underwatered. In 1965 a study began to determine the habitats of the desert and mountain bighorn, their number and distribution and range conditions. The 1965-66 study made it clear that water supplies set the range population boundaries. Mineral deficiencies are a secondary limiting factor of population. The combination of mineral and water deficiencies particularly stress very young and very old individuals. It is recommended that 35 watering sites be developed in the Wingate Mesa and its canyons. (Popkin-Arizona)

W71-01298

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 03C.
W71-01299

PERFORMANCE OF WINTER WHEAT VARIETIES UNDER DRYLAND AND IRRIGATED CONDITIONS, PLAINS BRANCH STATION, 1959-1966,
New Mexico Agricultural Experiment Station, University Park.
Ralph E. Finkner, David C. H. Hsi, and David B. Ferguson.
New Mexico Agricultural Experiment Station, Bulletin 524, April 1967. 9 p, 7 tab, 3 ref.

Descriptors: *Crop production, *Wheat, *Dry farming, *Irrigation effects, *New Mexico, Arid lands, Weight, Varieties, On-site tests.
Identifiers: *Crop performance, *Irrigated conditions, *Optimum yields, *Winter wheat, *Plains Branch Station (New Mexico), Tucumcari Irrigation Project (New Mexico), Irrigated crop, Dryland crop.

Winter wheat variety tests conducted from 1959 through 1966 at the Plains Branch Station, Clovis, New Mexico, included the varieties of Scout, Lancer, Winalta, Warrior, Tascosa and Cheyenne. Scout and Lancer produced the highest yields in four to five years of testing under irrigation. Tascosa, Winalta and Warrior had exceptionally high test weights. Sturdy, Caddo, Tascosa and Triumph were the shortest varieties in the irrigated tests. The highest yielding varieties under dryland conditions were Scout, Aztec and Cheyenne. All of these varieties have good to excellent milling and baking characteristics. Tables show yield properties and maturity rating of dryland and irrigated winter wheat varieties and monthly rainfall at the Station, 1959-66. (Popkin-Arizona)
W71-01396

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
David H. Williams, and Vernal H. Gledhill.
New Mexico Agricultural Experiment Station Bulletin 532, August 1968. 11 p, 5 tab, 2 fig.

Descriptors: *Fertilization, *Grains, *Sorghum, *Crop production, *Economic efficiency, Irrigation, Nitrogen, Phosphorous, Potassium, New Mexico, Arid lands, Data collections, Rates of application.
Identifiers: *Optimum yields, *Irrigated crops, *Regression response, *Net revenue return, *Northeastern Branch Station (New Mexico), Tucumcari Irrigation Project (New Mexico).

This four-year (1963-66) study was conducted because grain sorghum is one of the major crops grown on the Tucumcari Irrigation Project and producers lack information on optimum fertilizer applications. Yield response of NK-310 grain sorghum to nitrogen, phosphorous and potassium fertilizer applications and economic aspects of the responses were investigated. Nitrogen regression response on mean yield followed a quadratic equation with maximum yields at 213 pounds N. Maximum net returns from N at $21.67 per acre occurred at 172 pounds N. Phosphorous response increased linearly for application rates. There was a constant net revenue return of $0.19 per pound P up to 40 pounds P per acre. Combined N and P applications at the 172N-40P rate gave a yield of 5,887 pounds grain per acre, a net return over no ferilizer of $29.25 per acre. Plants were irrigated to maintain favorable conditions. Tables show cultural and climatic conditions of experiments, average yields under factorial fertilizer treatment, economic aspects, variance analysis and accumulated yields. Graphs of yields versus applied nitrogen and phosphorous are presented. (Popkin-Arizona)
W71-01397

GROWTH RATE OF WHEAT (TRITICUM AESTIVUM L., VAR. GAINES) AS A FUNCTION OF MOISTURE STRESS AND NITROGEN SUPPLY,
Oregon State Univ., Corvallis. Dept. of Soils.
Stephen Jimo Amujo.
M.S. Thesis, Oregon State University, 90 p, Submitted June 1970. 10 fig, 9 tab, 100 ref.

Descriptors: *Plant growth, *Moisture stress, *Nitrogen, *Soil moisture, *Wheat, Leaves, Osmotic pressure, Photosynthesis, Respiration, Growth rates, Growth chambers, Laboratory tests, Crop response, Soil-water-plant relationships, Root development. OWRR-001-ORE (7).
Identifiers: *Nitrogen deficiency, *Leaf area, *Dry matter production, Seedlings.

Crop production as determined by vegetative organ size is limited by both soil moisture and available N. These factors have differing effects on the growth rates and overall sizes of leaves and roots. Using a special constant moisture stress apparatus, the effects on wheat seedlings of 3 levels of moisture stress and 2 levels of N supply were studied with respect to: (1) rate of leaf area increase, (2) rate of dry matter increase and (3) total N content. With increasing available N, all 3 parameters increased due to more efficient photosynthesis, respiration and use of available water. With no N in the nutrient solutions, plant N contents decreased. Growth rates decreased with increasing moisture stress, the rate of decrease being greater between 0.35-1.00 bars than between 1.00-2.50 bars. Leaf area increase is more sensitive to N deficiency than to moisture stress. (Casey-Arizona)
W71-01398

COMPETITION FOR MOISTURE AMONG SEEDLINGS OF ANNUAL AND PERENNIAL GRASSES AS INFLUENCED BY ROOT ELONGATION AT LOW TEMPERATURE,
Washington State Univ., Pullman. Dept. of Forestry and Range Management.
Grant A. Harris, and A. M. Wilson.
Washington State University College of Agriculture scientific paper no. 3262. Supported in part by U.S. Department of Interior, Bureau of Land Management and Washington State University. Ecology, Vol 51, No 3, p 530-534, Late Spring 1970. 3 fig, 1 tab, 5 ref.

Descriptors: *Range grasses, *Competition, *Soil temperature, *Soil moisture, *Root development, Semiarid climates, Grama grasses, Wheatgrasses, Laboratory tests, Range management, Ecology, Soil-water-plant relationships, Grasses, Water utilization, Plant growth, Temperature, Vegetation establishment, Root systems.
Identifiers: *Seedlings, Perennial grasses, Annual grasses, Survival.

Seedlings of 2 important perennial species of wheatgrass, Agropyron spicatum (bluebunch wheatgrass) and A. desertorum (crested wheatgrass) often compete on western rangelands with 2 less desirable annuals, Bromus tectorum (Cheatgrass) and Taeniatherum asperum (medusahead). The competition often results in the hinderance of wheatgrass establishment. Roots of the annuals seem to grow faster at lower temperatures, leading to more efficient soil water utilization. Seedlings of all 4 species were grown in competition under differing temperature conditions. Cheatgrass, medusahead and crested wheatgrass roots penetrated the soil equally rapidly, remaining in favorable moisture conditions. Bluebunch wheatgrass roots were more slowly penetrating resulting in poor survival. In areas infested with these annuals, crested wheatgrass will therefore be more successful in competition. (Casey-Arizona)

W71-01399

ENVIRONMENTAL CHANGES AND THE ORIGIN OF AGRICULTURE IN THE NEAR EAST,
Minnesota Univ., Minneapolis. Dept. of Geology.
For primary bibliographic entry see Field 02B.
W71-01403

ON THE BIOLOGY OF THE DESERT TORTOISE TESTUDO SULCATA IN SUDAN,
Khartoum Univ. (Sudan). Dept. of Zoology.
J. L. Cloudsley-Thompson.
Journal of Zoology, London, Vol 160, No 1, p 17-33, March 1970. 6 fig, 3 tab, 24 ref.

Descriptors: *Reptiles, *Water conservation, *Water balance, *Life history studies, *Ecology, Arid lands, Transpiration, Evaporation, Heat resistance, Animal behavior, Xerophilic animals, Physiological ecology, Environmental effects, Drought tolerance, Food habits, Reproduction, Seasonal, Cooling, Animal metabolism, Water loss, Biorhythms, Temperature, Diurnal, Urine, Growth rates, Turtles.
Identifiers: *Tortoises, *Behavioral thermoregulation, *Africa, *Circadian rhythmns.

Desert tortoises are widely distributed in arid and semiarid regions of Africa south of the Sahara. Seven specimens were captured in the Khartoum area and allowed to reproduce. The food habits, growth, water and heat control mechanisms and ciradian rhythms of the offspring were studies. Copulation is most frequent after the rains have ended. A non-linear relationship obtains between length and weight and individuals vary widely in growth rate, tending to cluster in spaced groups. The animals survive indefinitely without water if fed green succulents. Younger animals probably have higher metabolic rates and this is reflected in their transpirational water loss which is mainly pulmonary. About half the water loss in adults occurs through cutaneous transpiration. Urine volume is a direct function of both temperature and food intake. Thermal regulation is primarily behavioral. When the temperature reaches 40-41 degrees C. the animals wet their heads, necks and forelegs by copious salivation which in turn produces evaporative cooling. This reaction is a heat response and is not photoactivated. There is a 24-hr circadian rhythmn which cannot be reset by interposed 3-hr light or dark periods. (Casey-Arizona)
W71-01404

HYGROSCOPIC ADDITIVES TO PHENOXY HERBICIDES FOR CONTROL OF SALTCEDAR,
Agricultural Research Service, Los Lunas, N. Mex Crops Research Div.
For primary bibliographic entry see Field 03B.
W71-01405

NON-AUTOTROPHIC CARBON DIOXIDE METABOLISM IN CACTI,
California Univ., Riverside. Dept. of Life Sciences and California Univ., Riverside. Dry-Land Research Inst.
Irwin P. Ting, and W. M. Dugger, Jr.
Botanical Gazette, Vol 129, No 1, p 9-15, March 1968. 7 fig, 6 tab, 22 ref. NSF Grant GB2547.

Descriptors: *Carbon dioxide, *Cacti, *Xerophytes, *Organic acids, *Physiological ecology, Stomata, Water conservation, Arid lands, Laboratory tests, Radiochemical analysis, Plant physiology, Light, Photosynthesis, Respiration, Carbohydrates, Metabolism, Mode of action, Photoactivation, Amino acids, Nocturnal, Diurnal, Desert plants, Hydrogen ion concentration, Acids, Data collections, Chromatography.
Identifiers: *Assimilation, *Carboxylation, Non autotrophic, Carbon-14.

Earlier data indicating significant levels of nighttime carbon dioxide uptake in crassulacean

succulents have been interpreted as a plant water conservation mechanism clue to daytime stomatal closure. Native cacti (Opuntia ramosissima) were kept in environmentally controlled chambers, subjected to alternating light-dark periods and incubated with C-14 in order to study the process of non-autotrophic carbon dioxide assimilation. Most of the tagged non-autotrophically ('dark') assimilated carbon dioxide appeared in organic acids (primarily malic acid) or amino acids. After daytime assimilation, some C-14 appeared in carbohydrates with slightly less in malic acid, indicating that the available amount of carbon dioxide is a limiting factor. The half-life of C-14 in organic acids is 408 min in the dark and 2,980 min in the light. Apparently malic acid accumulates and turns over at a rapid rate and its level at anytime is due to relative rates of carboxylation and decarboxylation. In both dark and light, C-14 release can be described by 2 first order equations. It is felt that the phenomenon of rapid turnovers does not support correlation with stomatal closures. Probably dark assimilation functions in part as a nucleotide rearrangement mechanism. (Casey-Arizona)
W71-01406

SOIL MOISTURE AND EFFECTIVENESS OF PREEMERGENCE HERBICIDES,
Illinois Univ., Urbana; and Danville Junior Coll., Ill.
R. L. Stickler, E. L. Knake, and T. D. Hinesly.
Weed Science, Vol. 17, No. 2, April 1969, p 257-259. 3 fig, 9 ref.

Descriptors: *Soil moisture, *Pre-emergents, *Herbicides, *Weed control, *Brush control, Plant growth regulators, Arid lands, Efficiencies, Moisture tention.
Identifiers: Herbicide efficiency, *Foxtail, Atrazine, EPTC, Amiben, Trifluralin, Propachlor, Methoxymethyl, CP 50144.

Rainfall or irrigation generally has been considered of importance for most preemergency herbicides to be effective. The relation between soil moisture and the effectiveness of preemergency herbicides for control of giant foxtail (Setaria jaberii Herrm.) was studies under greenhouse conditions using surface soil from Drummer silty clay loam with 25,31 and 27 percent moisture. Herbicides used were 2-chloro-4 ethylamino-6-isopropylamino-s-triazine (atrazine); ethyl N, N-dipropylthiocarbamate (EPTC); 3-amino-2, 5-dichlorobenzoic acid (amiben); alpha, alpha, alpha-trifluoro-2, 6-dinitro-N, N-dipropyl-p-toluidine (trifluralin); 2-chloro-N-isopropylacetanilide (propachlor); and 2-chloro-N- (methoxymethyl)2 prime, 6 prime diethyl-acetanilide (CP 50144). The effectiveness of atrazine and EPTC was increased when soil moisture was raised from 25 to 31 percent, but no further increase was obtained at 37 percent. Response to amiben and trifluralin increased linearly. Increasing moisture within this range had little effect on propachlor and CP 50144. Graphs of percent moisture versus soil tension, reduction in dry weight of different herbicides, and change in moisture in days are given. (Popkin-Arizona)
W71-01409

VASCULAR AQUATIC PLANTS FOR MINERAL NUTRIENT REMOVAL FROM POLLUTED WATERS,
Savannah River Ecology Lab., Aiken, S.C.
Claude E. Boyd.
Economic Botany, Vol 24, No 1, p 95-103, 1970. 1 fig, 4 tab, 31 ref. AEC AT (38-1)310.

Descriptors: *Water pollution, *Aquatic plants, *Inorganic compounds, *Nutrients, Vascular tissues, Eutrophication, Standing crop, Effluents, Fertilizers, Herbicides, Alligatorweed, Water hyacinth, Phytoplankton, Growth rates, Cattails, Productivity, Chemical analysis, Proteins, Sewage treatment, Nitrogen, Phosphorus, Ponds, Feeds, Mosquitoes, Insecticides, Viruses.
Identifiers: *Vascular aquatic plants, Forage, Eichhornia crassipes, Alternanthera philoxeroides, Pistia stratoites, Typha latifolia.

Aquatic plants have potential for nutrient removal and use as feedstuffs but economics of harvesting and processing would prohibit their direct utilization as a forage in technologically advanced nations. Nutrient removal systems based on the harvest of aquatic plants have potential application in removing nutrients from effluents and natural waters. Large quantities of all elements essential for plant growth would be removed in proportion to the compositional ratios of particular species. Harvested plants could be used as forage to offset partially cost of nutrient removal. Where practicable, such systems would turn excessive nutrients into fertilizers to increase aquatic plant production, and the economics of nutrient pollution abatement would be enhanced. Attention should be given to the possibility of pathogen (particularly virus) transfer from waste water to plants to animals to humans--most critical with municipal sewage. The unsuitability of feedstuffs from plants grown on certain wastes would not preclude the use of plants for nutrient removal or as green manures. The plants should be used as feedstuff, when possible, since green manures are of very low economic value. (Jones-Wisconsin)
W71-01487

2J. Erosion and Sedimentation

COMPOSITIONAL VARIATION IN PACIFIC OCEAN FERROMANGANESE NODULES AND ITS RELATIONSHIP TO SEDIMENT ACCUMULATION RATES,
Edinburgh Univ. (Scotland). Grant Inst. of Geology.
For primary bibliographic entry see Field 02K.
W71-01101

THE OCCURRENCE AND GEOLOGIC WORK OF RIP CURRENTS OFF SOUTHERN CALIFORNIA,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
David O. Cook.
Marine Geology, Vol 9, No 3, p 173-186, October 1970. 14 p, 6 fig, 1 tab, 18 ref. ONR Contract NR 083-144.

Descriptors: *Rip currents, *Sedimentation, *California, Waves (Water), Scour, Beach erosion, Sediment transport, Sands, Tides, Tidal effects, Currents (Water), Surf, Open channel flow.
Identifiers: Southern California, Redondo Beach (Calif).

An investigation of the occurrence of rip currents in southern California revealed that the development of these features is influenced by wave conditions, beach morphology, tidal level, and wind. The largest rips are formed during periods of intense wave activity. At Redondo Beach, rip currents selectively remove fine sand and mineral with a low specific gravity from the beach. Large rips transport significant quantities of sediment to the inner continental shelf. Rip current channel deposits are sedimentary structures which may aid in reconstructing paleoshorelines. (Knapp-USGS)
W71-01102

SOURCES AND DISTRIBUTION OF SUSPENDED SEDIMENT IN NORTHERN CHESAPEAKE BAY,
Maryland Dept. of Research and Education, Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 02L.
W71-01103

INDETERMINATE HYDRAULICS OF ALLUVIAL CHANNELS,
Geological Survey, Tucson, Ariz.
Thomas Maddock, Jr.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7696, p 2309-2323, November 1970. 15 p, 5 fig, 15 ref, append.

Descriptors: *Alluvial channels, *Channel morphology, *Sediment transport, *Sedimentary structures, *Channel erosion, Hydraulics, Discharge (Water), Sediment discharge, Open channel flow, Regime, Fluid friction.
Identifiers: Open channel hydraulics.

Field and laboratory data indicate that the relations among width, depth, velocity, and slope of alluvial channels are indeterminate unless the constraints on the development of the bed forms are known. A knowledge of the rate of sediment transport will usually satisfy this deficiency. Only a full knowledge of the response of one variable to changes in other variables will permit an evaluation and description of the relation of all the variables to each other. It is possible to predict general patterns of stream behavior. Actual stream behavior deviates about these general patterns in two ways. One is a statistical deviation expected when dealing in probabilities. The second results from a change in the general or usual relation between discharges of water and sediment and size of transported sediment. Because it is impossible to have an alluvial channel that will remain in equilibrium under a wide range of discharges of water and sediment, problems associated with alluvial channels can and must be resolved only by compromise. (Knapp-USGS)
W71-01110

AN EXPERIMENTAL STUDY OF SUBMARINE SAND BARS.
Corps of Engineers, Washington, D.C. Beach Erosion Board.

Available from NTIS as AD-701 197, $3.00 in paper copy, $0.95 in microfiche. 1970. 39 p. Technical Report No. 3.
Identifiers: *Ocean waves, *Sand, *Beaches, Erosion, Transport properties, Motion, Mathematical analysis, Beach erosion, *Sand bars, Sand ripples.

The paper reports the results of experiments made to determine the existence of basic relationhips governing sand bar phenomena. Observations were made of the form, dimensions, and number of bars; wave characteristics; ripple formation; and nature and volume of sand movement involved in bar phenomena.
W71-01128

GEOGRAPHY PROGRAMS, OFFICE OF NAVAL RESEARCH,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W71-01163

EROSION PROTECTION FOR THE OUTLET OF SMALL AND MEDIUM CULVERTS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 04A.
W71-01173

TIDAL FLAT SEDIMENTATION AT COOLEY LANDING, S. W. SAN FRANCISCO BAY,
Stanford Univ., Calif.
For primary bibliographic entry see Field 02L.
W71-01175

ESTIMATION OF RIVER BED AGGRADATION DUE TO A DAM,
Public Works Research Inst., Tokyo (Japan).
Akihiko Tsuchiya, and Katsuyoshi Ishizaki.
In: Proceeding 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 297-304, 1969. 8 p, 3 fig, 1 ref.

Descriptors: *Aggradation, *Dams, *Sedimentation, *Sediment transport, Streams, Sediment load, Mathematical studies, Simulation analysis, Sand waves, Dunes.

Identifiers: Japan.

A method for estimating river bed aggradation due to the construction of dams in torrential rivers is developed. The basic equation, which shows the degradation and aggradation of river beds, is developed from the condition of continuity and the discharge relation of bed load. Application of the equation to the Joganji River at the Hongu Dam, Japan shows a good agreement between calculated and observed data. A graph shows the height of aggradation with the change of time and distance. (Knapp-USGS)
W71-01214

PHYSICOCHEMICAL CONDITIONS OF DEPOSITION OF BACILLARIOPHYTA IN DAVIS LAKE, KLAMATH AND DESCHUTES COUNTIES, OREGON, U.S.A.,
Northeast Louisiana State Coll., Monroe. Dept. of Biology.
For primary bibliographic entry see Field 02H.
W71-01288

SELF-STABILIZING TENDENCIES OF ALLUVIAL CHANNELS,
Colorado State Univ., Fort Collins.
J. Gessler.
Proc Amer Soc Civ Eng, J Waterways Harbors Div, Vol 96, No WW2, p 235-249, May 1970. 15 p, 5 fig, 1 tab, 5 ref, 3 append.

Descriptors: *Alluvial channels, *Stable channels, Stabilization, Channels, *Channel erosion, Erosion, *Grain sizes, Hydrology, Sediment transport, Hydraulics, Stability, Alluvium, Streambeds, Degradation (Stream).
Identifiers: *Armoring (Streambed, *Stability coefficient.

Channels constructed in coarse alluvial material tend to develop an armor coat at the surface of the bed, protecting the material beneath the top layer from further erosion. A method is outlined for predicting the grain size distribution curve of such a self-stabilized armor coat and the eroded material. Based on the results, the minimum amount of material to be eroded prior to development of a stable condition resulting from armoring can be estimated. An attempt is made to determine those conditions which result in a finally stable bed. This leads to a design criterion for stable channels constructed in coarse, non-uniform alluvial material. The design criterion integrates the stabilizing influence of all grain sizes present in a self-stabilized armor coat and permits operating the channel at a present factor of safety. (USBR)
W71-01308

DISTRIBUTION OF ARSENIC IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05A.
W71-01325

WATERSHED MANAGEMENT AND SOIL EROSION PROBLEMS IN WEST PAKISTAN,
Muhammad Ishaq.
Pakistan Journal of Science, Vol 20, No 5 and 6, p 234-256, September-November 1968. 10 tab, 10 ref.

Descriptors: *Watershed management, *Reservoirs, *Soil erosion, *Floods, *Sediment load, Reforestration, Planning, Arid lands, River basins, Soil conservation, River basin development, Population, Water conservation, Water distribution (Applied), Water policy, Water resources, Erosion, Dams, Sedimentation, Silting, Grazing, Data collections, Livestock.
Identifiers: *West Pakistan, Overgrazing.

Although a number of reservoirs have been built in the major river basins of West Pakistan, the problems of flooding and sedimentation buildup have been critical, particularly in view of their impact on food production in an underdeveloped country. The problems are stated and clarified and a number of measures designed to abate these problems are reviewed. These measures include: (1) an estimate of river sedimentation loads, (2) a review of dam projects, (3) projected reforestration and other soil conservation measures and (4) an analysis of the magnitude of soil conservation problems. It is concluded that the basic problem is rooted in pressures of human over-population on available resources and their resulting restrictions on long term conservation projects. (Casey-Arizona)
W71-01400

KNIGHT V ROGERS (TITLE DISPUTE TO ACCRETIONS IN NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-01584

ISELIN V LA COSTE (TITLE TO ACCRETIVE LANDS).
For primary bibliographic entry see Field 06E.
W71-01598

WEST PENN RY V UMBEL (PROPERTY DAMAGE RESULTING FROM ROCK SLIDE; NEGLIGENT CONTAINMENT OF WATER).
For primary bibliographic entry see Field 06E.
W71-01601

PLATTSMOUTH BRIDGE CO V GLOBE OIL AND REFINING CO (OWNERSHIP OF ACCRETIVE LANDS).
For primary bibliographic entry see Field 06E.
W71-01613

2K. Chemical Processes

COMPOSITIONAL VARIATION IN PACIFIC OCEAN FERROMANGANESE NODULES AND ITS RELATIONSHIP TO SEDIMENT ACCUMULATION RATES,
Edinburgh Univ. (Scotland). Grant Inst. of Geology.
N. B. Price, and S. E. Calvert.
Marine Geology, Vol 9, No 3, p 145-171, October 1970. 27 p, 9 fig, 3 tab, 96 ref.

Descriptors: *Diagenesis, *Bottom sediments, *Pacific Ocean, *Manganese, Organic matter, Sedimentation, Sediments, Water chemistry, Oxidation-reduction potential, Oxidation, Reduction (Chemical), Mud-water interfaces, Sediment-water interfaces.
Identifiers: Manganese nodules.

Recent work on the geochemistry of deep- and shallow-water manganese nodules and the post-depositional migration of manganese and related metals in marine sediments emphasizes the role of diagenesis in the formation of manganese nodules and concretions. The Mn/Fe ratio in Pacific Sea floor nodules is highest along the eastern margin and lowest in the southwest central region. The Fe/Co and Mn/Ni ratios are also highest in the eastern Pacific but lowest in the north and south central Pacific. The enrichment of Mn in marginal nodules is caused by the diagenetic migration of Mn within the Recent sediments and its precipitation at the sediment surface. The Mn/Fe ratio is therefore a useful index of diagenetic derivation of metals in nodules. The depletion of minor metals in marginal nodules, in spite of an adequate source, must similarly be controlled by diagenetic processes within the sediments. Since diagenesis is largely governed by the organic matter in sediments and this depends on the rate of sediment accumulation, diagenesis is most marked in marginal, rapidly accumulating sediments and minimal in open oceanic sediments. The regional variations in nodule composition therefore reflect the broad pattern of sedimentation in the Pacific. (Knapp-USGS)
W71-01101

THE DIELECTRIC RELAXATION SPECTRA OF WATER, ICE, AND AQUEOUS SOLUTIONS AND THEIR INTERPRETATION. VIII. TRANSFER OF PROTONS THROUGH 'PURE' ICE I (h) SINGLE CRYSTALS. I. POLARIZATION AND CONDUCTION. III. EXTRINSIC- VERSUS INTRINSIC POLARIZATION: SURFACE VERSUS VOLUME CONDUCTION,
Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
For primary bibliographic entry see Field 01B.
W71-01127

THE EFFECTS OF SURFACE PROPERTIES OF WATER ON EVAPORATION AND CONDENSATION,
Rochester Inst. of Tech., N.Y.
Kenneth Hickman, Jer Ru Maa, Peter J. Harris, and Andrew Davidhazy.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.25 per copy. Office of Saline Water Research and Development Progress Report No 585, December 1970. 124 p, 42 ref. OSW Grant 14-01-0001-2119.

Descriptors: *Air-water interface, *Condensation, *Mass transfer, *Evaporation, *Boule flotation, Desalination, Distillation, Films, Surfaces.
Identifiers: Surface purification, Boules, Transfer coefficients.

Some of the many resistances which determine the rate of interchange between a liquid and its vapor were investigated. It was found that transport across new, clean liquid interfaces is dependent only on the gas laws and not on the chemistry of the fluids, and that the lowered transport in stagnant fluids is not wholly determined by physical factors but is also by impurities that happen to be present. To study new clean surfaces the authors have followed Rayleigh's classic advice to observe them as they emerge from an orifice. Jet tensimeters which expose moving streams of liquid for very short periods, A.02 sec., have been the principal instruments of the investigation. The present report considers the quest for purer water in the glass boulemaker and examines the change of behavior of boules floating on that water when various contaminants, notably the long chain fatty acids and alcohols are added. Similar effects have been recorded in the absence of boules by measuring superheat only. The authors noted repeatedly an increase in the superheat of a body of water on the addition of one molecule of a particular fatty acid to each 80 x 1,000,000 molecules of water. Finally a new study was made of the schizoid evaporating surface, which is a special example of Langmuir twitching. Although the condition can be induced on water only transiently and with great difficulty it is relevant to the study of water because contaminants influence surface movements in both cases and both can be induced by the stored energy of momentum. (Leiserson-Office of Saline Water)
W71-01198

MANGANESE IN SMALL FLOOD RETARDING IMPOUNDMENTS, WEST CENTRAL ARKANSAS,
Soil Conservation Service, Fort Smith, Ark., and Quachita Baptist Univ., Arkadelphia, Ark.
Patrick Burke, and J. Nix.
Typescript Report (1970) 11 p, 9 fig, 3 tab, 16 ref OWRR Project No A-999-ARK.

Descriptors: *Dissolved oxygen, *Manganese, *Water quality, *Reservoirs, Thermal stratification, Turnover, Water circulation, Thermocline, Arkansas, Water chemistry, Oxidation, Mixing.
Identifiers: Stratified reservoirs.

The distribution of dissolved oxygen and manganese was studied in six flood-water retarding impoundments in West Central Arkansas. This impoundments were observed to be in a stratified condition from June through September. Oxygen depletion, accompanied by a buildup of manganese, was observed in the lower portions of these impoundments. During periods of large inflow into the impoundments, the dissolved oxygen generally increased, accompanied by a decline in the manganese concentration. (Knapp-USGS)
W71-01207

SALT-FERTILIZER-SPECIFIC ION INTERACTIONS IN SOIL,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 03C.
W71-01283

DISTRIBUTION OF MERCURY IN NATURAL WATERS OF THE SOUTHERN SLOPE OF NORTHWESTERN CAUCASUS (IN RUSSIAN),
Severo-Kavkaeskogo Geologicheskogo Upravleniya, Laurskaya Gidrogeologichyeskaya Psartiya.
For primary bibliographic entry see Field 05B.
W71-01481

2L. Estuaries

SOURCES AND DISTRIBUTION OF SUSPENDED SEDIMENT IN NORTHERN CHESAPEAKE BAY,
Maryland Dept. of Research and Education, Solomons. Chesapeake Biological Lab.
R. B. Biggs.
Project partly financed by Corps of Engineers. Marine Geology, Vol 9, No 3, p 187-201, October 1970. 15 p, 5 fig, 5 tab, 12 ref. Bureau of Sport Fisheries and Wildlife Contract 14-16-0005-2096.

Descriptors: *Suspended load, *Seston, *Estuaries, *Provenance, Sedimentation, Runoff, Erosion, Oxidation, Organic matter, Silts, Clays, Currents (Water), Waves (Water), Sedimentation rates, Water chemistry.
Identifiers: Chesapeake Bay, Sediment budget.

Sources and losses of total suspended matter (seston) and organic carbon are identified and estimated for northern Chesapeake Bay. Suspended matter in the northernmost segment of the Chesapeake is dominated by a fluvial source with a significant contribution from shore erosion. About 23% of the total input of particulate material is lost from the northernmost section, but only 4% escapes downstream while 19% is organically oxidized within the area. The nominal sedimentation rate for the northern bay is 3.7 mm/year. The middle section of the Chesapeake is dominated by sources of suspended matter from shore erosion and phytoplankton production. Approximately 41% of the total mass of suspended matter is lost from the middle Chesapeake; 23% of the total input to the middle bay is lost downstream, while an additional 18% is organically oxidized. Nominal sedimentation for the middle bay is 1.1 mm/year. (Knapp-USGS)
W71-01103

CARBON-14 AGES RELATED TO OCCURRENCE OF SALT WATER,
Geological Survey, Washington, D.C.
William Back, Bruce B. Hanshaw, and Rubin Meyer.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7702, p 2325-2336, November 1970. 12 p, 8 fig, 2 tab, 12 ref. Grant ARO-5839-EN.

Descriptors: *Saline water intrusion, *Groundwater movement, *Withdrawal, *Radioactive dating, South Carolina, Carbon radioisotopes, Tracers, Chlorides, Hydrogeology, Recharge, Pumping, Water resources development.
Identifiers: *Hilton Head Island (SC).

Under native conditions in Hilton Head Island, S. C., the original regional flow path was generally from the south end to the north end of the island. At the south end, the fresh water (less than 35 mg per 1 chloride content) is older than 22,000 yr. In the central and higher part of the island, the age of the fresh water ranges from about 2,000 yr to 12,000 yr. This age range is interpreted to mean that with a lowering of regional head, owing to heavy pumping in the Savannah, Ga., area, regional flow has reversed, and recharge is being induced into the aquifer in this area. In the central part of the island, the deeper contaminated zone (chloride content about 1,500 mg per 1) has an age of about 26,000 yr B.P. In the northern part of the area, water of the same chloride content has an age of about 7,000 yr B.P. In this study, therefore, radiocarbon concentrations show: (1) The effects of reversal of flow; (2) the area of resultant recharge; (3) the area of modern ocean-water encroachment; and (4) the area of contamination by saline formation water. (Knapp-USGS)
W71-01107

ECOLOGICAL STUDIES OF MARINE PLANKTON,
TRW Systems Group, Redondo Beach, Calif. Physical Research Center.
Vakula S. Srinivasan, and Herbert P. Silverman.
Available from NTIS as AD-702 499, $3.00 in paper copy, $0.95 in microfiche. Rept no. 07966-6002-R000. Final Report, February 70. 29 p.
Identifiers: *Ecology, Plankton, *Plankton, Stereoscopic photography, Marine biology, Recording systems, Lasers, Illumination, Optical equipment, Holography.

Holographic techniques for the ecological study of marine plankton were examined. Holocamera design, laser illumination sources and recording emulsion requirements were investigated. Exploratory work on phototactic responses of marine organisms and holographic moves for the locomotion of copepods were performed. Image reduction techniques for the study of large volumes were investigated. A technique for recording large volume scenes was successfully demonstrated.
W71-01125

ORGANIZATION AND DISTRIBUTION OF PHOTOPLANKTON COMMUNITIES,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
Ramon Margalef.
Available from NTIS as AD-702 468, $3.00 in paper copy, $0.95 in microfiche. Final Technical Report, January 30, 1970. 14 p. ONR Contracts Nonr-3447 (00), N62558-4287, F61052-67-C-0013.
Identifiers: *Plancton, Distribution, *Ecology, Plankton, Sampling, Chemical analysis, Quantitative analysis, Population, Measurement, Statistical analysis, Nutrition, Light, Organic pigments, Marine biology, Sea water, Hydrographic surveying, Spain, *Phytoplankton.

The different measurements of environmental factors or of phytoplankton populations, obtained in different points of a volume of water, can never be considered as random samples of an uniform statistical universe. It is more appropriate to study distributions as dependent of position in space and, as manifestations of an 'organization'. The density of one given species in a small volume of water is not only a function of local environmental properties, but also depends on the concentration of the same species in some neighboring area. Diffusivity and water turbulence is very important, as are the gradients and generated flows. Patches of strongly stratified water, poor in nutrients is another unit of reference. A careful consideration of the distribution of phytoplankton advises a change in the order of importance given to the different factors. Salinity and temperature have been often considered as very important factors in plankton distribution, but from recent evidence turbulence and nutrient contents are, besides light, the chief factors in explaining phytoplankton populations. It was discovered that not only total amount of plant pigments, but also relative concentration of pigments could be meaningful. Pigment ratios could be substituted, in the practice, by ratios between absorbancies at given wavelengths of the pigment extracts. Thus, progress in plant physiology emphasizes the idea that the diversity of pigments is an expression of properties of the photosynthetizing apparatus, and that the said pigment ratios, besides any taxonomical interpretation, have implications of true ecological relevance concerning the degree of evolution or the stage of succession.
W71-01132

AN OCEANOGRAPHIC SURVEY OF THE COASTAL WATERS BETWEEN SAN FRANCISCO BAY AND MONTEREY BAY, CALIFORNIA,
Naval Postgraduate School, Monterey, Calif.
Peter Stephen Labyak.
Available from NTIS as AD-703 645, $3.00 in paper copy, $0.95 in microfiche. Master's thesis, October 1969. 316 p.
Identifiers: *Sea water, Optical properties, Underwater sound, Sound transmission, Temperature, Salinity, Density, Oxygen, Phosphates, Nitrogen compounds, Hydrographic surveying, Bathythermograph data, Theses, Monterey Bay, San Francisco Bay, Litoral drift, Upwelling, *Optical oceanography.

A detailed oceanographic survey of the coastal waters between Monterey Bay and San Francisco Bay, California, was conducted from 10 through 18 May 1969. Measurements of beam transmittance, sound velocity, temperature, and particulate count were obtained. Over 500 water samples were taken for particulate analysis. The optical properties of this region were found to be very complex. The waters appeared to be affected by flow from San Francisco Bay, littoral material, upwelling, and possibly sewage outfalls during the survey. A greater volume of water with low transmissivity and high particle count existed in the northern region of the survey area than in the southern region. An eddy system between Monterey Bay and Point Ano Nuevo was suggested. Approximately 90 percent of the particles affecting beam transmittance were less than 12 microns in diameter. Particle sizes were found to decrease with increased depths. A fairly good correlation of beam transmittance with particle count was observed except in near shore areas.
W71-01152

REMOTE SENSING OF COASTAL WATERS USING MULTISPECTRAL PHOTOGRAPHIC TECHNIQUES,
Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
For primary bibliographic entry see Field 07B.
W71-01162

GEOGRAPHY PROGRAMS, OFFICE OF NAVAL RESEARCH,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
W. G. McIntire.
Available from NTIS as AD-705 130, $3.00 in paper copy, $0.95 in microfiche. Final rept., 15 Mar 59 - 31 Mar 70, April 15, 1970. 78 p. Contract Nonr-1575 (03).
Identifiers: *Naval research, Seacoast, *Seacoast, Reports, Tropical cyclones, Coral reefs, Swamps, Avalanches, Beaches, Rock (Geology), Abstracts, Sedimentation, Plants (Botany), Ecology, Ice islands, Geologic age determination, Rivers, Deltas, Louisiana, Beach erosion, Seacoast protection, Coastal environment, Atolls, Geomorphology, Reefs.

The Final Report covers research on Geography Programs, Office of Naval Research, covering the period March 15, 1959, through March 31, 1970. The present program is interdisciplinary in scope, involving three major categories of coastal investigation: coastal environments, coastal dynamics, and coastal information management and model simulation. This activity and the orientation are relevant to user needs. The abstracts of publications presented in this report as listed sequentially by Technical Report numbers. A small section listing reports in press and one outlining those in the miscellaneous category complete the report.
W71-01163

A VARIABLE-BOUNDARY NUMERICAL TIDAL MODEL,
Alaska Univ., College. Inst. of Marine Science.
John C. Mungall, and J. Brian Matthews.
Available from NTIS as AD-705 610, $3.00 in paper copy, $0.95 in microfiche. March 1970, 157 p. Report Number R70-4.
Identifiers: *Estuaries, Tides, *Tides, Boundary value problems, Mathematical models, Computer programs, Inland waterways, California, Cook Inlet, Gulf of California, Fiord inlets.

A numerical tidal model using equations developed by Hansen (1952) and Yuen (1967) is automated to the point where the potential user need not undertaken extensive reprogramming. The user adds to the program only those cards needed to specify tides at input points as a function of time; the application of the relevant calculations at each grid point being controlled by an integer matrix that corresponds to the inlet boundary. A sample problem is covered in detail and applications of the model to the M2 tide of the Gulf of California and to a hypothetical mean tide in Cook Inlet are shown.
W71-01167

SEASONAL PHENOMENA IN THE PLANKTON OF THE LABRADOR SHELF, THE GRAND BANK OFF NEWFOUNDLAND AND FLEMISH CAP,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 02I.
W71-01168

TIDAL FLAT SEDIMENTATION AT COOLEY LANDING, S. W. SAN FRANCISCO BAY,
Stanford Univ., Calif.
Raymond Pestrong.
Available from NTIS as AD-702 059, $3.00 in paper copy, $0.95 in microfiche. Stanford Univ Technical Report 1969, 55 p. ONR Contract Nonr-4430 (00).
Identifiers: *Bays, Sedimentation, Mud, Floods, Erosion, Transport properties, Sampling, Clay, Silt, Sand, Drainage, Grasses, Radiography, Aerial photography, Water pollution, California, San Francisco Bay, Tidal marshes, Levees, Mud flats.

Tidal marsh and mud flat sedimentation is being studied on portions of the southwestern side of San Francisco Bay. Sediments transported and deposited within this low energy environment are distributed in accordance with a principle of scour and settling lag proposed for sediments in the North Sea. The finer sediments are concentrated nearer the higher portions of the tidal flats and marshes where lower ebb flow velocities are unable to transport them farther bayward. Greater quantities of bedload sediment are moved on the flood than on the ebb portions of the tidal cycle both on the tidal flat and through the marsh channel system. A sediment budget is maintained within the tidal marshes, whereby the growth of the tidal channels accompanies the extension of the marsh onto the tidal flat. This development is documented on aerial photographs taken during a six-year period. Higher shear strengths and densities are displayed by the slightly elevated tidal channel levees than are present for the adjacent mud flats because of the longer periods of desiccation the levees experience. X-radiologic studies of near-surface tidal flat mud slabs show sedimentary structures not apparent in photographs, and suggest penecontemporaneous deformation of the muds.
W71-01175

NUMERICAL COMPUTATION OF FULLY STRATIFIED FLOW,
Waterloopkundig Laboratorium, Delft (Netherlands).
C. B. Vreugdenhil.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 37-44, 1969. 8 p, 3 fig, 5 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Tidal effects, *Mathematical models, *Mixing, Turbulent flow, Critical flow, Streamflow, Hydraulics, Stratified flow, Tides, Water level fluctuations, Currents (Water), Unsteady flow.
Identifiers: Netherlands.

A numerical method was used to calculate the dynamic behavior of a salt wedge in an estuary, as influenced by tidal conditions. Salt and fresh layers are assumed not to mix; the technique, however, can be used also with mixing. A major physical difficulty is the occurrence of supercritical flow at the seaward end of the estuary. A solution is given for a case in which this difficulty does not occur. (Knapp-USGS)
W71-01238

EXPERIMENTAL AND THEORETICAL MODELING OF SALINE WEDGES,
Tokyo Inst. of Tech. (Japan). Dept of Civil Engineering.
Hiroyoshi Shi-Igai, and Masaki Sawamoto.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 29-36, 1969. 8 p, 10 fig, 7 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Mixing, Hydraulic models, Streamflow, Tidal effects, Water level fluctuations, Tides, Mathematical studies, Equations, Water quality, Salinity.
Identifiers: Japan.

The intrusion length of saline wedges in weakly mixing extuaries was computed in nondimensional form. Model tests were also made for strong mixing rivers. Ultrasonic vibrators were used to obtain a strong mixing condition in the laboratory. Mixing phenomena are reproduced in the smaller channels fairly well. (Knapp-USGS)
W71-01239

COMPUTATIONS OF TIDAL PROPAGATION WITH REFERENCE TO TAN-SHUI RIVER,
Chang-ling Liu.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 21-28, 1969. 8 p, 4 fig.

Descriptors: *Tides, *Estuaries, *Mathematical models, Water level fluctuations, Floods, Flood forecasting, State-discharge relations, Frequency analysis, Fourier analysis, Tidal effects, Digital computers.
Identifiers: Taiwan.

Computation of tidal propagation is based on the equation of motion, in which the frictional effect is dominant in shallow rivers. The equation can be linearized, because the resistance force itself is periodic in nature. The nonanalytic function of the frictional term in terms of tidal flow was developed into power series, and later to the form of Fourier series. By using the boundary conditions and introducing the assumed tidal flow through the iterative process, the problem can be solved in general. Two tributaries join the main river in Taipei City, Taiwan. A mathematical model is applied to the whole system in which the controlled conditions are at boundaries and confluences. Model tidal flow at the river mouth is 1560 cms and at a bottleneck of the river, flow is around 1000 cms. The record flood at Kuan Tu is 24,800 cms. Therefore the tidal flow has little effect on the flood peak. (Knapp-USGS)
W71-01240

SOME PRACTICAL ASPECTS OF TIDAL COMPUTATIONS,
Delta Project, The Hague (Netherlands). Hydraulics Dept.
J. J. Dronkers.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 11-20, 1969. 10 p, 5 fig, 7 ref.

Descriptors: *Tides, *Tidal effects, *Estuaries, *Mathematical models, Model studies, Currents (Water), Sedimentation, Equations, Water level fluctuations.
Identifiers: Finite-difference equations.

In recent years, tidal computations on electronic computers have been used when planning engineering projects in tidal areas. Sometimes such computations are used together with hydraulic tidal models. Some practical aspects of the use of tidal computations for rivers and coastal areas are reviewed. One-dimensional or two-dimensional computations may be made for the transitional area of a river, that is the transition between a river and the sea, or an estuary. Both explicit and implicit finite difference systems are discussed. Some aspects of boundary conditions, forces that determine tidal movements in a coastal area, and effect of variations in density due to salinity intrusion on the tidal conditions of a river are discussed. (Knapp-USGS)
W71-01241

A COMPARATIVE STUDY OF REFLECTION IN A TIDAL CHANNEL AND IN ITS DISCRETIZED SIMULATED MODEL,
Calcutta Port Commissioners (India); and Jadavpur Univ., Calcutta (India).
K. K. Bandyopadhyay, and S. Das Gupta.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 1-9, 1969. 9 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Tides, *Tidal effects, *Waves (Water), *Estuaries, Currents (Water), Navigation, Mathematical studies, Analog models, Water level fluctuations.
Identifiers: India.

Tidal propagation in estuaries was studied mathematically and by an analog model. In a long channel tapering upstream, siltation in the tidal apex can cause tidal-wave reflection. In many such channels, shallow reaches are numerous, and each shallow reach causes a reflection. Model studies were conducted with an exponentially tapered channel. In such a channel, both the hydraulic impedance and admittance varies continuously. Rigorous and exact mathematical solution is possible only when the exact variations of these parameters in the longitudinal direction are known. In this paper, such a tidal river is simulated by a discretized linear analog model. (Knapp-USGS)
W71-01242

WATER LEVEL FLUCTUATION DUE TO SAND BARRIERS BUILT UP BY EFFLUENT AND WAVE AT RIVER MOUTH,
Osaka Univ. (Japan). Dept. of Civil Engineering.
Toru Sawaragi.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 69-76, 1969. 8 p, 13 fig, 5 ref.

Descriptors: *Estuaries, *Sedimentation, *Water level fluctuations, *Sand bars, Hydraulic models, Mathematical models, Stage-discharge relations, Backwater.
Identifiers: River-mouth bars.

Tidal hydraulic computation in a tidal river was based on a cross-section of channel and on the outlet boundary condition. However, the cross-section at a river mouth may decrease due to a sand barrier built up by wave and tidal action. Estimation of water level elevation at the river mouth under the interaction of scour and waves (which gives the boundary condition) is a complicated problem. Water levels with no effluent, no waves, or co-existence of flow and wave are obtained for various cross-sections of the model river mouth. The change of cross-sectional area of a river due to scouring action of flow and closing action of wave is shown by an experiment using a movable bed and barrier. Water level fluctuations and sand barrier movement are estimated from the model results. (Knapp-USGS)
W71-01245

THE INFLUENCE OF FRICTION ON THE PROPAGATION OF TIDES (FRENCH),
Politecnico di Torino (Italy). Inst. of Hydraulics and Hydraulic Construction.
Giannantonio Pezzoli.
In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 95-101, 1969. 7 p, 7 ref.

Descriptors: *Waves (Water), *Tides, *Tidal effects, *Estuaries, Mathematical studies, Water level fluctuations, Fluid friction, Channel morphology, Fluid mechanics.
Identifiers: Tidal wave propagation.

Tidal wave propagation by level oscillations of sinusoidal law was studied in channels with gradually variable section and friction. Wave attenuation was described using the methods of nonlinear mechanics. In the case of a horizontal bottom bed and constant section, a wave damps like the amplitude of a harmonic oscillator with square resistance. (Knapp-USGS)
W71-01248

A NUMERICAL MODEL OF A WIDE SHALLOW ESTUARY,
M. B. Abbott, and G. Marshall.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 61-67, 1969. 7 p, 7 fig, 3 ref.

Descriptors: *Tides, *Estuaries, *Currents (Water), *Mathematical models, Flow, Streamflow, Tidal effects, Equations, Water level fluctuations, Discharge (Water), Open channel flow, Overland flow, Diffusion, Tidal marshes.
Identifiers: Netherlands.

A numerical model was made of an estuary in which flood and ebb flows are primarily in the direction of the estuary axis along deeper channels, but mainly transverse across drying flats. Flow parallel to the channel axis follows the dynamic equations of nearly-horizontal flow, while transverse flow follows a diffusion equation. The resulting equations are solved numerically using a two-level implicit scheme. This is unconditionally stable with a second-order truncation error that is entirely composed of phase error. The computation of diffusion coefficients necessitates an inverse mode capability that corresponds to the construction of a data-reversible system. Test computations with diffusion coefficients set constant give satisfactory results. (Knapp-USGS)
W71-01250

SALINITY DIFFUSION AT THE INTERFACE OF STRATIFIED FLOW IN AN ESTUARY,
Hokkaido Univ., Sapporo (Japan). Dept. of Engineering Science.
Hisao Fukushima, Isao Yakuwa, and Susmu Takahashi.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 191-197, 1969. 7 p, 8 fig, 2 ref.

Descriptors: *Stratified flow, *Estuaries, *Saline water intrusion, Saline water-freshwater interfaces, Density stratification, Mixing, Dispersion, Diffusion, Turbulence, Vortices, Sampling, Sounding, Instrumentation.
Identifiers: Japan.

Salinity diffusion was studied at the mouth of the Ishikari River, Japan. The behavior of the salt wedge was observed by an ultrasonic method. The salinity distributions at the river mouth were obtained by chemical analysis and measurement of electrical conductivity. Longitudinal distributions of the surface salinity were calculated and found to agree with the observational results. When the salt wedge is advancing or static, the interface is clear. On the other hand, when the wedge is retrograding, the interface is diffusive. (Knapp-USGS)
W71-01251

A COMPUTER SIMULATION STUDY OF TRAVELTIMES OF INJECTED PARTICLES AND TIDE-WAVES IN WELL-MIXED ESTUARIES,
Geological Survey, Washington, D.C. Water Resources Div.
Chintu Lai.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 123-130, 1969. 8 p, 3 fig, 8 ref.

Descriptors: *Waves (Water), *Tides, *Streamflow, *Computer models, *Estuaries, Currents (Water), Mathematical models, Model studies, Tidal effects, Water level fluctuations, Tracers, Tracking techniques, Water circulation.
Identifiers: Computer graphics.

A mathematical model using the method of characteristics and numerical procedures was constructed to simulate the unsteady motion of the water-surface profile and the movements of index particles in well-mixed estuaries. Techniques in computer graphics were applied to the model so that the numerical data of computer output representing the complex motions of water-surface movement, wave propagation, particle injection, and its travel along the channel can be graphically displayed. Two examples, one for a hypothetical tidal reach and the other for an actual tidal reach in the Connecticut River were used to illustrate computer animation and x-y plotting as graphical outputs. Examination of the results reveals that a large amount of qualitative and quantitative information concerning traveltimes of index particles and tide-waves can be obtained and clarified by this approach. (Knapp-USGS)
W71-01252

TIDES AND LONG PERIOD WAVES ON CONTINENTAL MARGINS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Coastal Engineering.
Richard Silvester.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 113-121, 1969. 9 p, 4 fig, 5 ref.

Descriptors: *Waves (Water), *Tides, *Surges, *Surf, Ocean waves, Beach erosion, Mathematical studies, Shores, Beaches.
Identifiers: Wave attenuation, Shoaling.

Heights in the deep ocean of tidal or other long waves can be amplified some twenty times by shoaling, reflection and co-oscillation over the Continental Shelf and within embayments. The main criterion for this is the ratio of the Shelf width (or embayment dimensions) to the wave length involved. Graphs are presented from previous analyses for use in a step procedure to determine the shoreline heights from those pertaining in the open ocean. Attenuation effects are included by providing information on the friction factor and its influence on the length and height of these shallow water waves. (Knapp-USGS)
W71-01253

CROSS-SECTIONAL TIME SCALES AND DISPERSION IN ESTUARIES,
California Univ., Berkeley, Calif. Dept. of Civil Engineering.
Hugo B. Fischer.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 173-180, 1969. 8 p, 2 fig, 8 ref. NSF Grant GK-3210.

Descriptors: *Estuaries, *Saline water intrusion, *Saline water-freshwater interfaces, *Mixing, *Dispersion, Diffusion, Velocity, Turbulence, Tidal effects, Tides, Steady flow, Unsteady flow, Mathematical studies, Mathematical models.
Identifiers: Oscillating flow.

An oscillating flow is considered in an estuary of constant cross-section. Analytical study shows that longitudinal dispersion is caused by velocity variations in both the vertical and the transverse direction, and that the two effects are separate and additive. Lagrangian time scales can be defined separately for vertical and transverse velocity variations. Both Lagrangian scales can be related to their respective time scales for cross-sectional mixing by a factor which depends only on velocity distribution and cross-sectional shape, and varies only over a limited range. Thus the longitudinal dispersion coefficient can be estimated from knowledge of the cross-sectional mixing time scales. The longitudinal dispersion coefficient in an oscillating flow has a maximum value dependent on the mean square velocity deviation and the tidal period, but independent of the size of the cross-section. A net steady flow component causes dispersion at a rate independent of the presence of the oscillation; the dispersion coefficients caused by the steady and oscillating components are additive. (Knapp-USGS)
W71-01254

FLOW PATTERN OF DENSITY CURRENT AT A RIVER MOUTH,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01255

NUMERICAL ANALYSIS ON THE SALINITY INTRUSION IN THE TIDAL ESTUARY OF WELL-MIXED TYPE,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
K. Shinohara, T. Tsubaki, Y. Awaya, and K. Furumoto.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 165-172, 1969. 8 p, 4 fig.

Descriptors: *Saline water intrusion, *Saline water-freshwater interfaces, *Mixing, *Estuaries, Dispersion, Diffusion, Salinity, Sea water, Surveys, Data collections, Sampling, Numerical analysis, Mathematical models.
Identifiers: Japan.

A one dimensional diffusion equation for salinity intrusion in well mixed estuaries was solved numerically, under proper boundary conditions. In this procedure, the numerical calculation is simplified by transforming the independent variable of the position of any cross section into the storage volume above the section. The value of longitudinal diffusion coefficient multiplied by the square of the cross sectional area is assumed to be a function of volume only. Example of numerical results are shown for the estuaries in some simple forms, in which the salinity concentration at the entrance of the estuary is kept equal to that of the sea water. The numerical result for a simplified channel form of a trigonal pyramid shows fairly good agreement with the field data obtained at the Chikugo River, Japan. (Knapp-USGS)
W71-01256

ON THE STATISTICAL PROPERTIES OF INTERNAL WAVES FORMED AT THE INTERFACE OF ARRESTED SALINE WEDGES,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
T. Tsubaki, M. Hamamura, and M. Hasimoto.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 157-164, 1969. 8 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Waves (Water), *Saline water intrusion, *Saline water-freshwater interfaces, *Estuaries, Tides, Tidal effects, Frequency analysis, Fourier analysis, Statistical methods, Statistics, Statistical models.
Identifiers: Internal waves, Interfacial waves, Spectral analysis.

A series of laboratory experiments were carried out on the statistical properties of the internal wave formed at the interface of an arrested saline wedge. The internal wave is the overlapping of waves of short period wave on those of long period, and is composed of wide range of frequency components. The frequency spectrum of internal wave follows a -5/3 power law near the first energy peak corresponding to long waves and has an equilibrium range that follows a -3 power law in the high frequency range. Saline spectra in the neighbourhood of an interface were evaluated and the mechanism of mixing phenomena was studied in connection with the internal wave spectrum. Wave height and wave velocity of the internal wave were evaluated experimentally. (Knapp-USGS)
W71-01257

AMPLITUDE OF TEMPERATURE AND SALINITY VARIATIONS IN THE WATER OF THE SEBOU ESTUARY (MOROCCO), (FRENCH),
M. Combe.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 141-156, 1969. 16 p, 7 fig, 1 tab, 13 ref.

Descriptors: *Estuaries, *Tidal effects, *Saline water intrusion, *Discharge (Water), Streamflow, Water level fluctuations, Salinity, Water chemistry, Profiles, Sampling.
Identifiers: Morocco.

The Sebou river has the greatest discharge of Moroccan rivers; it empties into the ocean through an estuary where the influence of the sea is very strong. When the river is at its lowest, the dynamic effects of tide are felt up to 85 Km from its mouth. Series of measurements were taken in 1966 when river water level fell exceptionally low. Such measurements enabled determination of the maximum limits of salt water intrusion (35 Km from the river mouth) as well as the thermic variations of water (40Km). A graph synthetizes the salinities reached in the longitudinal section of the estuary. (Knapp-USGS)
W71-01258

TRANSFORMATION AND RUN-UP OF TSUNAMI TYPE WAVE TRAINS ON A SLOPING BEACH,
Tetra Tech, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 08B.
W71-01259

ON DIFFUSION OF SALINITY IN SEA AREA WITH TRIBUTARY RIVERS--CASE OF ARIAKE BAY NEAR THE RIVER CHIKUGO,
Ministry of Agriculture and Forestry, Yawata (Japan). Agricultural Engineering Research Station, and Japan Engineering Consultants Co., Ltd., Tokyo.
Juichi Kato, Seiya Hagino, and Isao Akizuki.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 199-206, 1969. 8 p, 5 fig, 6 ref.

Descriptors: *Estuaries, *Saline water systems, *Sedimentation, *Computer models, *Computer programs, Mathematical models, Model studies, Water resources development, Urbanization, River basin development.
Identifiers: Japan, Ariake Bay.

Information on the distribution of tidal currents and salinity density in the vicinity of estuaries is both extremely important and indispensable for the establishment of rational and comprehensive development plans for various industries. To obtain a solution in the bounds in which Navier-Stokes equation and the diffusion equation may be applied, electronic computer programs were developed. Ariake Bay, Japan which was selected as an example, has complicated boundaries and drifting sand in its currents. (Knapp-USGS)
W71-01260

TURBULENT DISPERSION IN PERIODIC FLOW,
Kyushu Univ., Fujuoka (Japan). Dept. of Hydraulic Civil Engineering.
Awaya Yoichi.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 207-214, 1969. 8 p, 4 fig, 6 ref.

Descriptors: *Dispersion, *Turbulent flow, *Mixing, *Estuaries, Unsteady flow, Tides, Tidal effects, Stratified flow, Water level fluctuations.
Identifiers: Oscillating flow, Longitudinal dispersion.

The longitudinal dispersion of matter in a mixed estuary is usually regarded as the same as that for a steady flow. In some estuaries, however, where the length travelled by water particles during a half tide is not sufficiently large compared with a linear dimension of a cross section, the mean value of dispersion coefficient during a tidal cycle is considerably decreased. The dispersion of matter in periodically alternating currents through a pipe is considered theoretically and experimentally, and an approximate formula of dispersion coefficient in alternating current is proposed. (Knapp-USGS)
W71-01261

A GRAPHICAL SUMMARY OF DISSOLVED-OXYGEN DATA FOR THE DELAWARE RIVER ESTUARY FOR WATER YEARS 1965-69,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 05A.
W71-01327

A LOOK AT THE HUDSON RIVER ESTUARY,
Geological Survey, Garden Grove, Calif.
Mark W. Busby, and Kenneth I. Darmer.
Water Resources Bulletin, Vol 6, No 5, p 802-812, September - October 1970. 11 p, 6 fig, 3 ref.

Descriptors: *Estuaries, *Hudson River, *Tides, *Waves (Water), Tidal effects, Discharge (Water), Water level fluctuations, Data collections, Stream gages, Gaging stations, Flowmeters, Current meters, Hydrologic data, Stage-discharge relations, New York.
Identifiers: Hudson River Estuary (NY).

Background information is provided on the effect of tidal waves upon the movement of water in the Hudson River estuary. Three continuous stage recorders were operated and current-meter discharge measurements were made throughout a tidal cycle. Peak discharge rates in the estuary at Poughkeepsie may be as great as 500,000 cubic feet per second and total daily tidal volumes as great as 20 billion cubic feet move in the estuary. (Knapp-USGS)
W71-01331

RESOURCE MANAGEMENT IN THE COASTAL ZONE: THE POLICY PROBLEM,
Clemson Univ., S.C. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 06B.
W71-01352

HYDROGRAPHY OF THE PAMLICO RIVER ESTUARY, N.C.,
North Carolina Water Resources Research Inst., Raleigh.
John E. Hobbie.
Available from tNTIS as PB 195-780, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute, Report No. 39, August 1970. 69 p, 6 tab, 37 fig, 17 ref. OWRR Project B-004-NC (5).

Descriptors: Hydrography, *Oceanography, Estuaries, *Salinity, *Dissolved oxygen, *Temperature, *Tidal effects, Wind tides, North Carolina.
Identifiers: Pamlico Sound,.

The Pamlico River Estuary extends some 35 miles from Washington, N. C. to Pamlico Sound. It is shallow, from 2 to 6 miles wide, naturally productive and has from 0.5 to 15 or 20 ppt salinity. The salinity regime is determined chiefly by the quantity of inflowing freshwater and changes in salinity of up to 10 ppt are common at any station. Lunar tides are small (less than 0.5 ft) but wind and wind tides can have important effects on the salinity distribution. In addition, the Coriolis Force causes much of the freshwater to flow along the south side of the estuary. The temperatures range from 3C (37F) to 34C (93F), although temperatures above 31C (89F) are unusual. On any given day, there could be horizontal temperature differences of up to 4 degrees (C) or 7 fahrenheit degrees. The estuary stratifies irregularly; when this happens in the summer complete deoxygenation may occur. This condition may last for only a week and then be destroyed by wind. The benthic animals (bottom dwelling) are completely eliminated from large stretches of the river by the low concentrations of oxygen. (Howells-North Carolina)
W71-01359

COASTAL CHANGES,
Cambridge Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 06B.
W71-01366

RECENT DATA ON THE LEVEL OF PRIMARY PRODUCTION OF THE WORLD OCEANS (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
O. I. Koblenz-Mishke, V. V. Volkovinskii, and Yu G. Kabanova.
Doklady Akademii nauk SSSR, Vol 183, No 5, p 1189-1192, 1968. 1 fig, 1 tab, 5 ref.

Descriptors: *Primary productivity, *Oceans, Pacific Ocean, Atlantic Ocean, Indian Ocean, Carbon.
Identifiers: Hydrosphere, Equatorial divergencies, Polar divergencies, Steeman estimates, Nielson estimates, Jensen estimates.

The international expeditions of the last 15 years permitted a revision of the world's ocean map of primary production. The largest part of recent information, reported in the article, was acquired by the use of different modifications of radiocarbon method. The average productivity of oceans in grams of carbon per square meter/year is: Pacific - 46.4, Atlantic - 69.4, Indian - 81.0, all seas - 97.8. In the less generalized subdivision, different parts of oceans are characterized by the following values of production in mg carbon per square meter/day: Oligotrophic waters of central subtropics - 70, transitional waters between subtropical and subpolar zones - 140, waters of equatorial divergence and oceanic regions of subpolar zones - 200, nearshore waters - 340, and neritic waters - 1000. The total production of the world's entire hydrosphere is estimated between 25 and 30 billion metric tons of carbon per year, with net production between 15 and 18 billion tons. (Wilde-Wisconsin)
W71-01482

SPECIFIC PECULIARITIES IN THE VERTICAL CIRCULATION OF WATER IN THE ARCTIC OCEAN (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
V. N. Stepanov.
Doklady Akademii nauk SSSR, Vol 187, No 1, p 187-189, 1969. 2 fig, 6 ref.

Descriptors: *Ocean circulation, *Arctic Ocean, Surveys, Temperature, Salinity, Topography, Currents (Water), Turbulence, Benthos, Alaska.
Identifiers: *Vertical water circulation, North Pole, Spitsbergen.

This estimate of the vertical and horizontal translocation of water in the deep part of the Arctic Ocean was accomplished on a basis of survey along a transect laid out across the North Pole from Spitsbergen to Alaska. The vectors of vertical currents were established by a solution of two equations incorporating projections of the rate of vertical and meridian currents, coefficient of turbulent diffusion, and temperature and salinity of water. The deviations in the vertical circulation are attributed to the great topographical diversity of the bottom of the Arctic basin. (Wilde-Wisconsin)
W71-01483

DOMINANT FORMS OF PHYTOPLANKTON OF THE WHITE SEA (IN RUSSIAN),
V. D. Fedorov.
Doklady Akademii nauk SSSR, Vol 188, No 4, p 913-916, 1969. 2 fig, 2 tab, 2 ref.

Descriptors: *Marine microorganisms, *Phytoplankton, Shores, On-site data collections, Distribution patterns, Surveys.
Identifiers: *Karelian Shore, White Sea, Technometric survey.

The results are reported of a technometric survey of phytoplankton of the White Sea section near the Karelian shore during the growing season of 1968. Among the 52 species only 11 to 16 could be rated as 'dominant'. However, even their dominance was confined to certain segments of the vegetative period delineating the following four subdivisions: Spring--dominance of Thalassiosira gravida, Fragilaria oceanica, and Nitzschiafrigida; biological summer--Skeletonema costatum; the end of summer--Nitzschia delicatissima; fall-Dinophysis norwegica. (Wilde-Wisconsin)
W71-01484

STUDY OF THE ANNUAL CYCLE OF PLANKTONIC CHAETOGNATHS IN VILLEFRANCHE BAY BY THE METHOD OF PRINCIPAL COMPONENT ANALYSIS (IN FRENCH),
Station Zoologique, Villefranche-sur-Mer (France).
F. Ibanez, and S. Dallot.
Marine Biology, Vol 3, p 11-17, 1969. 7 fig, 3 tab, 18 ref.

Descriptors: *Worms, *Bays, *Analysis, Cycles, Nets, *Plankton.
Identifiers: *Planktonic chaetognaths, Villefranche Bay (France), Annual cycle, Principal component analysis, Sagitta, Juday-Bogorov net.

The annual cycle of chaetognaths was studied on samples collected from 0 to 75 meter depths with a Juday-Bogorov's net. The analysis singled out 2 communities of abundant species and 3 isolated species of worms among the 13 sorted categories. The first 3 components comprised 71.1% of the total variance. A partial correlation has indicated that the first component is trophic conditions, the second--vertical stability of water, and the third--the development of young stages. The acquired information yielded a 45% correlation between the physical and biological factors. (Wilde-Wisconsin)
W71-01495

DETERMINATION OF ASSIMILABILITY OF ALGAE, YEASTS, AND BACTERIA BY CERTAIN REPRESENTATIVES OF CLADOCERA (IN RUSSIAN),
For primary bibliographic entry see Field 02H.
W71-01496

A DISCOVERY OF A DEPOSIT OF PHOSPHORITIC CONCRETIONS IN THE INDIAN OCEAN (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Geologii.
V. Kh Gevorkian, and Yu G. Chugoonnyi.
Doklady Akademii nauk SSSR, Vol 187, No 4, p 906-908, 1969. 1 fig, 9 ref.

Descriptors: *Indian Ocean, Hydrogeology, Geologic formations, Rocks, Cenozoic era, Mesozoic era, Stratigraphy.
Identifiers: *Phosphorites, Meso-Cenozoic formations, Phosphorus pentoxide, Calcium oxide, Iron hydroxide, Sokotra Island, Aden Bay, Arabian Peninsula.

A deposit of phosphorites was discovered at a depth of 210 meters in the Aden Bay, near the Sokotra Island. The excavated sample of about 1.1 kg contained 326 loam-textured concretions of highly diversified form, surface appearance, and mantles of benthic organisms. The average contents of phosphorus pentoxide and calcium oxide are 28.6 and about 44%, respectively. The probable source of phosphorites are Meso-Cenozoic deposits forming the Sokotra and adjacent islands. (Wilde-Wisconsin)
W71-01497

DECREASE IN THE ROLE OF WARMWATER PLANKTONIC CONSTITUENTS IN THE POSYET BAY (SEA OF JAPAN) (IN RUSSIAN),
M. S. Kos.
Doklady Akademii nauk SSSR, Vol 184, No 4, p 951-954, 1969. 2 fig, 15 ref.

Descriptors: *Bays, *Aquatic life, *Ocean circulation, Fish, Zooplankton, Plankton, Crustaceans.
Identifiers: *Posyet Bay, *Sea of Japan, Pacific Ocean sardine, Japanese current, Paracalanus parvus, Calanoida, Cladocera.

Analyses of samples and fish harvest during the past 30 years have shown a partial decrease or disappearance of several warmwater species of fish, including the valuable Pacific Ocean sardine, as well as many benthic crustaceans from the Posyet Bay, adjacent to the Zaliv of Petra Velikogo. The 1965 sampling has failed to reveal any Paracalanus parvus, one of the widely distributed and important member of Calanoida crustaceans. A decrease or disappearance was also recorded for the following tropical or subtropical members of the plankton: Labidocera pavo, Labidocera bipinnata, Labidocera japonica, Arcatia pacifica, Penilia aviostris, Acartia plumosa, Evadne tergestina, Evadne spinifera. These changes in the general hydrothermic and biotic conditions are presumably caused by the meandering of the Japanese Current. (Wilde-Wisconsin)
W71-01498

INTERNATIONAL HELGOLAND SYMPOSIUM ON THE CULTIVATION OF MARINE ORGANISMS AND ITS IMPORTANCE FOR MARINE BIOLOGY, 9-12 SEPTEMBER 1969,
Office of Naval Research, London (England).
James E. Hanks, and John D. Costlow, Jr.
Available from NTIS as AD-701 193, $3.00 in paper copy, $0.95 in microfiche. ONR (London) Conference Report, ONRL-C-3-70, January 22, 1970. 17 p.
Identifiers: *Marine biology, Symposia, West Germany, Aquatic animals, Fishes, Crustacea, Mollusca, Plankton, Microorganisms, Growth, Commerce, Seafood, *Aquaculture.

The program of the four-day symposium, 'Cultivation of Marine Organisms and Its Importance for Marine Biology', held at the Biological Institute, Helgoland, West Germany, Sept. 9-12, 1969, is reported. Some 250 scientists attended to hear 75 papers which covered both basic and applied aspects of cultivating fish, crustaceans, molluscs, lower invertebrates, plants and a variety of microorganisms. Two informal sessions, Fish Farming and Cultivation of Phytoplankton Populations, were also held to discuss the present state of knowledge and to define areas requiring further study both for scientific purposes and to allow commercial development ofmarine organisms.
W71-01504

DETAILED TEMPERATURE CROSS SECTION OF THE COLD-WATER BELT ALONG THE NORTHERN EDGE OF THE KUROSHIO,
Scripps Institution of Oceanography., La Jolla, Calif.
Yutaka Nagata.
Available from NTIS as AD-703 344, $3.00 in paper copy, $0.95 in microfiche. Journal of Marine Research, Vol 28, No 1, 1970, p 1-14. 7 fig, 6 ref.
Identifiers: Honshu (Japan), Ofunato Bay, *Cold water belts, *Bathythermograph data, Japan, *Sea water, Temperature, Seacoast, Temperature inversion, Depth finding, Surface temperatures, Hydrographic surveying, Bays.

On the basis of BT observations made at intervals of about one mile, a detailed temperature cross section of the cold-water belt along the northern edge of the Kuroshio is presented. Cold waters and sharp temperature inversions have been observed on the southern and northern margins of the cold-water belt. Within the cold-water belt, except in a narrow noninversion area, many temperature inversion layers have been observed, and the colder and warmer waters are arranged in a complicated pattern. These observations suggest that the very cold waters in the cold-water belt are fed through a cold-water core parallel to and off the Sanriku coast of Honshu, Japan.
W71-01507

ACOUSTIC TECHNIQUES OF FISH POPULATION ESTIMATION WITH SPECIAL REFERENCE TO ECHO INTEGRATION,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 02H.
W71-01508

THE EFFECT OF CYCLONIC AND ANTICYCLONIC WATER MOVEMENTS ON THE DISTRIBUTION OF ORGANIC MATTER,
Goddard Space Flight Center, Greenbelt, Md.
K. H. Szekielda.
Available from NTIS as N70-22597, $3.00 in paper copy, $0.95 in microfiche. NASA TMX-63849, Feb 70. 17 p, 5 fig, 7 ref.

Descriptors: *Ocean currents, Hydraulic model, *Remote sensing infrared radiation, *Organic matter, *Aquatic life.
Identifiers: *Stoichiometrical model, Somali Coast, Infrared radiometer.

An anticyclonic water movement directed away from the upwelling region along the Somali Coast was detected with the high resolution infrared radiometer aboard the meteorological satellite Nimbus 2. The effect of this water movement on the distribution of organic matter is shown with a stoichiometrical model, based on elementary analyses of phytoplankton. The predicted position of the maximum of the organic material was verified with chlorophyll measurements near the Somali Coast.
W71-01513

PHOTOSYNTHETIC ACTION SPECTRA OF MARINE PHYTOPLANKTON 1966-1969,
Scripps Institution of Oceanography, La Jolla, Calif.
Francis T. Haxo.
Available from NTIS as AD-704 176, $3.00 in paper copy, $0.95 in microfiche. Final rept, Nov 1, 1966-Sept 30, 1969. April 6, 1970. 11 p. Rept No SIO-Ref-70-12. ONR Contract N00014-67-A-0109-0005.
Identifiers: *Plankton, *Photosynthesis, Marine biology, Algae, Light, Chlorophylls, *Phytoplankton.

Much of our knowledge concerning the wavelength dependence of photosynthesis in marine phytoplankton has been derived indirectly from laboratory studies of photosynthetic oxygen evolution in cultured micro-algae or on thin bladed macroscopic algae. Studies on unicellular algae have been limited to a rather few species, mostly freshwater, and naturally occurring populations have not been examined. The present investigation was undertaken to provide such information for a wider variety of marine micro-algae representing diverse pigment systems and to examine wavelength and light intensity dependence of photosynthesis in natural occurring oceanic populations. Results obtained to date are briefly summarized in this report.
W71-01526

SEDIMENTS, OCEANOGRAPHIC OBSERVATIONS, AND FLORISTIC DATA FROM TAMPA BAY, FLORIDA, AND ADJACENT WATERS, 1961-65,
Bureau of Commercial Fisheries, St. Petersburg Beach, Fla. Biological Lab.
John L. Taylor, and Carl H. Saloman.
Available from NTIS as PB-189 117, $3.00 in paper copy, $0.95 in microfiche. Contribution No 51, December 1969. 561 p, 39 ref.
Identifiers: *Oceanographic data, Florida, *Ocean bottom sampling, Sedimentation, Algae, Temperature, Salinity, Calcium compounds, Carbonates, Invertebrates, Carbon compounds, Organic compounds, Silicates, Particle size, Statistical data, Bays, Tampa Bay, Cores.

Sediment type at each of 773 stations is characterized, and isopleths of mean grain size, sorting, calcium carbonate, and organic carbon are given. Oceanographic data include water temperature, salinity, pH, and water depth. The occurrence of sea grasses and filamentous algae is noted. Methods of sampling and analyses are described.
W71-01537

CHANGES IN ELECTROLYTIC CONDUCTANCE OF SEAWATER DURING PHOTOSYNTHESIS AND RESPIRATION,
Woods Hole Oceanographic Institution, Mass.
P. Kilho Park, Alvin L. Bradshaw, David W. Menzel, Karl E. Schleicher, and Herbert C. Curl, Jr.
Available from NTIS as AD-702 217, $3.00 in paper copy, $0.95 in microfiche. Journal of the Oceanographic Society of Japan, Vol 25, No 3, p 119-122, June 1969. 1 fig, 12 ref. ONR Contract Nonr-1286 (00), 2196 (00).
Identifiers: *Sea water, Electrical conductance, *Plants (Botany), Sea water, Electrolytes, Salinity, Photosynthesis, Respiration, Ions, Carbonates, Photosynthetic assimilation.

Common rock weed, Fucus vesiculosis, decreased the seawater conductance by 0.04 percent during a photosynthetic assimilation of 0.4 mM of inorganic carbon dioxide, but it only increased the conductance by 0.02 percent during the respiration. Transformation of bicarbonate to carbonate ions during photosynthesis and vice versa during respiration are the main mechanism to change the conductance.
W71-01538

WASTE MANAGEMENT CONCEPTS FOR THE COASTAL ZONE, REQUIREMENTS FOR RESEARCH AND INVESTIGATION.
National Academy of Sciences-National Research Council, Washington, D.C. Committee on Oceanography.
For primary bibliographic entry see Field 05G.
W71-01544

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF AN IMPROVED TUBULAR REVERSE OSMOSIS MODULE FOR WATER TREATMENT,
Philco-Ford Corp., Newport Beach, Calif.
John L. Richardson, Gilbert Segovia, and Alexander O. Brodie.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $1.25 per copy. Office of Saline Water Research and Development Progress Report No 576, December 1970. 113 p, 15 tab, 58 fig, 10 ref. OSW Contract 14-01-0001-2206.

Descriptors: *Reverse osmosis, *Membranes, Membrane processes, Desalination, Permselective membranes, Semi-permeable membranes, Osmosis.
Identifiers: Reverse osmosis module.

Tubular membrane casting and heat treating techniques have now been improved to the point where reproducibility in product flux is within approximately one percent. By using sufficiently short evaporation times during the casting process, the salt-rejection properties of the membrane can be significantly increased. Viscosity data was obtained for the standard cellulose acetate casting solution over a wide range of shear rates. The data was fit with a modified hyperbolic model. A continuous tubular caster design was developed using the results of the fabrication variables study and the viscometric measurements. It is based on the principle of extrusion through an annular orifice onto moving split and butted tapes shaped into a cylindrical configuration. The continuous casting machine was built and operated. Tubular membranes up to approx. 20 feet in length were produced with this experimental device. Selected fiberglass yarns have been braided into sleeving and tested with tubular (approx. 1/4 in. in diameter) membranes. A small (approx. 1 gal/day) reverse osmosis demonstration unit was designed, built, and tested. (Kindley-Office of Saline Water)
W71-01199

SCALE CONTROL IN HIGH TEMPERATURE DISTILLATION OF SALINE WATER USING FLUIDIZED BED HEAT EXCHANGERS,
Brookhaven National Lab., Upton, N.Y.
L. P. Hatch, and G. G. Weth.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $0.65 per copy. Office of Saline Water Research and Development Progress Report No 571, July 1970. 61 p, 23 fig, 11 tab. OSW Contract 14-01-0001-1151.

Descriptors: *Scaling, *Sea water, *Fluidization, *Descaling, *Distillation, *Temperature, *Erosion control, Desalination, *Heat exchangers, Desalination apparatus.
Identifiers: High temperature, Fluidized bed, Scale filtration.

The report describes a method investigated during past three years for achieving scale free operation in the high temperature heating of saline waters by use of a fluidized bed of granular solids on the saline water side of a vertically oriented heat exchanger. Deposition of precipitated salts, largely calcium sulfate was mainly on the granular solids which present very large surface area to the solution. The mild scouring action of the hot moving bed prevented the formation or build-up of deposits on the heat exchanger or the particles. Bed materials used included balls of 1/8 in. alumina and bronze, 3/16 in. stainless steel, 0.08 in. lead shot, 0.05 in. copper shot, and 1/8 in. Cu-Ni cylinders. Scale prevention tests were conducted in single tube units and a 7-tube unit at temperatures from 340 degrees F to 400 degrees F, operated in the once-through and recirculation flow modes. It was found that scale could be removed by both a monel and porous carbon filter of 5 micron pore size. At 400 degrees F, the scale was a soft slurry easily purged but at 350 degrees F a more dense scale was found which built up on the filters. Erosion tests for up to 5000 hours at 300 degrees F were made on a number of bed materials. 3/32 in. carpenter 20 discs showed 2.2% weight loss in 1 year, stainless steel 316 - 3.5% loss, and 3/32 in 90-30 CuNi cylinders - 8.8% loss. Erosion was largely confined to rounding off of the corners. No reduction in tube wall thickness was found in any of the units. Results are reported for a 7-tube Lucite unit used to determine the basic requirements for maintaining uniform distribution of bed material among tubes. The fluidized bed offers a means for scale control to permit high temperature operations of sea water distillation plants. The economics of this scale control method was not determined. (Pruett-Office of Saline Water)
W71-01200

ASSEMBLY AND EVALUATION OF AN IMPROVED PPB OXYGEN ANALYZER FOR SEAWATER,
Dow Chemical Co., Freeport, Tex.
H. C. Behrens, E. F. Sablatura, J. D. Theologos, and B. P. Webb.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402 Price $0.65 per copy. Office of Saline Water Research and Development Progress Report No. 572, (1970). 60 p, 4 tab, 16 fig, 27 ref, 4 append. OSW Contract 14-01-0001-1832.

Descriptors: *Dissolved Oxygen Analyzer, *Deaeration, *Corrosion, *Sea water, Desalination.
Identifiers: Monitoring Devices, Control Systems, Polarographic Analyses.

Studies currently under way on the behavior of metals in desalination environments indicate the extreme importance of dissolved oxygen in influencing the corrosion rate of common metals. OSW R. and D. Report No. 417, 'Seawater Corrosion Test Program', U. S. Department of the Interior, 1968. At the present state of the art, distillation-type desalination plants are designed to operate

under deaerated conditions. As the deaeration techniques are improved, resulting in lower and lower levels of dissolved oxygen, the ability to monitor those levels is taxed. In high purity boiler feed water, a number of commercial instruments have demonstrated accurate measurement of dissolved oxygen in the low parts-per-billion (ppb) range. Other commercial instruments have successfully measured dissolved oxygen at parts-per-million (ppm) levels in various fresh and saline streams. None of these have been successful at levels of 0 to 10 ppb oxygen in seawater under desalination plant environments. This report covers the development and proving of an on-stream oxygen analyzer system capable of accurate dissolved oxygen measurements in the range of 0 to 10 ppb in seawater. (Filban-Office of Saline Water)
W71-01201

STUDY OF WATER PLANT ISOLATION FROM CONTAMINATION,
National Nuclear Corp., Palo Alto, Calif.
Fredrick Crever.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $1.50 per copy. Office of Saline Water Research and Development Progress Report 526, October 1969. 147 p, 37 tab, 17 fig. OSW Contract No. 14-01-0001-2192.

Descriptors: *Desalination, *Distillation, *Nuclear power plants, *Flash distillation.
Identifiers: Water plant isolation, Water-Power plant combination, *Nuclear contamination.

The scope of this effort included a determination of the potential of radioactive contamination of product water from a MSF desalination plant when water plant is connected to a nuclear power plant. Data from existing nuclear power plants was reviewed and analyzed. The report also includes recommendations on isolation of the water plant brine heater where steam is taken directly from the nuclear power plant and where an intermediate heating system is used to provide steam to the brine heater. (Robinson-Office of Saline Water)
W71-01202

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,
Westinghouse Ocean Research Lab., San Diego, Calif.
For primary bibliographic entry see Field 05C.
W71-01266

3B. Water Yield Improvement

EFFECTS OF SIMULATED CLOUD SEEDING ON STREAMFLOW OF SELECTED WATERSHEDS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
William E. Sopper, and L. A. V. Hiemstra.
Water Resources Bulletin, Vol 6, No 5, p 754-766, September - October 1970. 13 p, 8 fig, 8 tab, 4 ref. Bureau of Reclamation Contract 14-06-D6571.

Descriptors: *Cloud seeding, *Rainfall - runoff relationships, *Low-flow augmentation, *Simulation analysis, *Pennsylvania, Mathematical models, Simulated rainfall, Water supply, Streamflow, Hydrograph analysis, Weather modification, Droughts.
Identifiers: Simulated cloud seeding.

A mathematical model was developed to simulate the hydrologic behavior of five small watersheds in central Pennsylvania. Continuous hydrographs for the 6-month period, April to September 1964, were simulated. Synthesized rainfall cycles consisting of increasing rainfall by 10, 20, and 30% to simulate the effects of cloud seeding were processed through the watershed model to determine the effects on low flow augmentation. Other rainfall cycles used consisted of increasing every third storm by 30% and of developing a rainfall cycle by processing daily radiosonde data through a mathematical cumulus cloud model to obtain a prediction of rainfall following seeding. A comparison of actual and predicted hydrographs indicated that simulated cloud seeding resulted in significant monthly and seasonal water yields. In general, the results of the study appear to indicate that on a theoretical basis cloud seeding would be a feasible method of augmenting low streamflow during the summer months on watersheds in the northern Appalachian region. (Knapp-USGS)
W71-01116

CLOUD SEEDING EXPERIMENT - TASMANIA, 1965 - 1966 ANNUAL REPORT,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
E. E. Adderley, and E. J. Smith.
Available from NTIS as N70-17006, $3.00 in paper copy, $0.95 in microfiche. January, 1969. 200 p. RPR-168.
Identifiers: *Australia, *Cloud seeding, *Rain, *Silver iodides, Airborne equipment, Cumulus clouds, Rain gages.

Experiments are being conducted to determine the amount by which seeding clouds with silver iodide smoke released from an aircraft can increase precipitation in a hydroelectric catchment area. The seeding takes place during alternate years according to a randomized time pattern. Clouds are considered suitable for seeding if their tops consist of supercooled water drops at -10 deg C or colder for cumulus clouds, and -5 deg C for stratiform clouds; if they are dense, durable, and compact; and if they have a lifetime exceeding 30 minutes. Rainfall measurement methods are described. Figures depict cloud and wind conditions, target and control rainfall, seasonal variations, and variations with time. Rainfall totals are tabulated for seeded and unseeded periods.
W71-01129

EVAPORATION FROM SNOW AND EVAPORATION RETARDATION BY MONOMOLECULAR FILMS. A REVIEW OF LITERATURE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Charles W. Slaughter.
Available from NTIS as AD-708 860, $3.00 in paper copy, $0.95 in microfiche. CRREL Special Report 130, June 1970. 30 p.
Identifiers: *Snow, Evaporation, *Evaporation, Control, *Monomolecular films, Snow, Protection, Melting, Water vapor, Temperature, Wind, Velocity, Moisture, Reviews, Humidity, Barometric pressure, *Snow evaporation, *Evaporation retardation.

Evaporation from snow is discussed. Methods of determining snow evaporation are explained; a summary of available data on snow evaporation is presented. The general field of evaporation retardation is also discussed, along with the limited information currently available on retardation of evaporation from snow.
W71-01143

SOME PROBLEMS CONCERNING THE TECHNIQUE OF SEEDING SUPERCOOLED STRATUS CLOUDS FOR THE PURPOSE OF SCATTERING THEM,
Foreign Technology Div., Wright-Patterson AFB, Ohio.
S. K. Kudryavtseva, and I. P. Polovin.
Translated from Russian. Available from NTIS as AD-705 146, $3.00 in paper copy, $0.95 in microfiche. 23 March 70, 25 p, Rept no FTD-MT-24-50-70. March 1970. 20 p. FTD-MT-24-50-70.
Identifiers: *Stratus clouds, Artificial precipitation, Scattering, Rainfall, Fog, Atmospheric sounding, Nucleation, Ice, Crystallization, Wind, USSR, Translations, *Cloud seeding, Fog dispersal.

A report on cloud seeding and dispersion of stratus clouds is presented. To update methods of inducing rain and dispersing clouds and fog, it is necessary to determine optimum intervals between the seeding lines. An experimental study was carried out by the Ukranian Hydrometeorological Research Institute for this purpose in the following manner: after sounding the cloud layer and establishing its parameters, initial seeding was made to find the maximum width of crystallization zone. Then the seeding was repeated along five or six lines normal to the wind direction at the cloud top level. Experiments showed that for complete dispersal of clouds the stage of cloud development is an important factor in determining the interval between the seeding lines. The experiments also indicated that larger dosages of seeding substances produce complete dispersion of clouds in the growing phase.
W71-01164

WATERSHED MANAGEMENT AND SOIL EROSION PROBLEMS IN WEST PAKISTAN,
For primary bibliographic entry see Field 02J.
W71-01400

HYGROSCOPIC ADDITIVES TO PHENOXY HERBICIDES FOR CONTROL OF SALTCEDAR,
Agricultural Research Service, Los Lunas, N. Mex. Crops Research Div.
Eugene E. Hughes.
Weed Science, Vol 16, No 4, October 1968, p 486-488. 6 tab, 5 ref.

Descriptors: *Herbicides, *Brush control, *Tamarisk, *Evaporation control, *Phreatophytes, Plant growth regulators, 2, 4-D, 2, 4, 5-T, Southwest U. S., Arid lands, Air temperature, Humidity, Spraying, Chemcontrol, Greenhouses, Foliar application.
Identifiers: *Hygroscopic additives, *Phenoxy herbicides, *Herbicide evaporation, *Polypropylendiol, Phreatophyte invasion, Silvex, Foliage injury.

Water supplies in southwestern United States have been greatly influenced by the invasion of phreatophytes into river basins. These experiments were conducted to determine the possibility of preventing rapid herbicidal evaporation due to high temperature and low humidity. Greenhouse studies on saltcedar (Tamarix pentandra Pall) control showed that when one of the hygroscopic compounds (polypropylenediol) was added to water solutions of phenoxy herbicides, it significantly increased injury from most treatments. Foliage injury from herbicides tested, except the oil-soluble amine formulations of 2,4-dichloro-phenoxyacetic acid (2, 4-D), 2- (2, 4, 5-trichlorophenoxy), PPROPIONIC ACID (silvex), and 2, 4-D plus 2, 4, 5-trichlorophenoxy acetic acid (2, 4, 5-T) (1:1), increased when polypropylenediol was added to the spray solution at 5 percent by volume. The increased activity was affected by the rate of the additive, temperature, humidity, and herbicidal formulation. Tables show influence of hygroscopic compound, polypylenediol, artifical rain, humidity and temperature. (Popkin-Arizona)
W71-01405

SELECTIVE CONTROL OF PLAINS PRICKLYPEAR IN RANGELAND WITH HERBICIDES,
Nebraska Univ., Lincoln. Dept. of Agronomy.
G. A. Wicks, C. R. Fenster, and O. C. Burnside.
Nebraska Agricultural Experiment Station, Journal Series, Paper No 2496. Weed Science, Vol 17, No 4, October 1969, p 408-411. 5 tab, 12 ref.

Descriptors: *Plant growth regulators, *Great plains, *Ranges, *Herbicides, *Brush control, Spraying, 2-4-5-T, Nebraska, Arid lands, Semiarid climates, Chemcontrol, Wetting, Treatments.
Identifiers: *Pricklypear, *Herbicide efficiency, *Silvex, *Dicamba, *Plant injury, Picloram, Semiarid lands, Rotary hoeing.

Pricklypear inhabits rangeland throughout the Great Plains and other arid to semiarid lands. Experiments were conducted at Crawford and Kimball, Nebraska, during 1962 to 1965 to determine the effect of 13 herbicides on plains pricklypear (Opuntia polyacantha Haw.). The best control was obtained with 2- (2,4,5-trichlorophenoxy) propionic acid (silvex), 4-amino-3,5,6-trichloropicolinic acid (picloram), 3,6-dichloro-o-anisic acid (dicamba), and (2,4,5-trichlorophenoxy) acetic acid (2,4,5-T). Silvex and picloram were superior to dicamba and 2,4,5-T in controlling plains pricklypear, but picloram and dicamba injured native grasses. Rotary hoeing plains pricklypear cladodes just prior to spraying improved herbicide performance. Simulated railing was not a consistent control measure. Evaluation of plains pricklypear control was made 1 and 2 years after herbicide application. Tables of plains pricklypear control in west Nebraska rangeland, and effect of rotary hoeing and herbicide spraying are included. (Popkin-Arizona)
W71-01408

ATMOSPHERIC MODELING, FIELD PROGRAMS, AND DECISION SYSTEMS,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 02B.
W71-01535

3C. Use of Water of Impaired Quality

SALT-FERTILIZER-SPECIFIC ION INTERACTIONS IN SOIL,
New Mexico State Univ., University Park. Dept. of Agronomy.
H. E. Dregne, and Hessam Mojallali.
New Mexico Agricultural Experiment Station Bulletin 541, January 1969. 16 p, 10 tab, 4 fig, 13 ref.

Descriptors: *Soil-water-plant relationships, *Ion exchange, *Crop production, *Salt tolerance, *Salinity, Fertilizers, Saline water systems, Saline soils, Cation exchange, Electrical conductance, Barley, Sodium chloride, Potassium compounds, Nitrogen, Phosphorous, New Mexico, Arid lands, Irrigation effects, Salts, Hydrogen ion concentration, Seeds, Sulfates, Soil chemical properties, Greenhouses, Data collections.
Identifiers: *Ion antagonism, *Salt-fertilizer interaction, *Salinity damage, *Crop cation content, *Exchangeable cation content, Specific ion interaction, Cations, Anions.

Excessive soil salinity is a continuing problem in irrigated areas throughout the world. The purpose of these reported experiments is to determine the effectiveness of ion antagonism and salt fertilizer interactions in reducing salinity damage to barley. Greenhouse experiments in a calcareous Berino sandy loam with factorial treatments of sodium chloride, potassium chloride, nitrogen, and phosphorous were conducted on barley. Applications of N-, P-, K- fertilizers reduced the adverse effect of low-to-moderate levels of soil salinity on yields. Yields were depressed more by KCl than by NaCl. Barley cation content varied directly with soil salinity. NaCl was more detrimental than sulfate to crop yields. Tables present data on pretreatment soil properties, treatments to determine salt-fertilizer and specific ion effects, treatment ion ratios, crop yields, barley cation and anion content, soil water soluble and exchangeable cation content, crop yields and electrical conductivity of soil saturation extract. Figures of electrical conductivity of soil saturation extract versus crop yield and pH, and percent salt versus exchangeable cations in soil are included. (Popkin-Arizona)
W71-01283

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
New Mexico State Univ., University Park. Dept. of Agronomy.
H. E. Dregne.
New Mexico Agricultural Experiment Station, New Mexico State University, Bulletin 543, March 1969. 16 p, 7 tab, 16 fig, 3 ref. OWRR Project A-005-NMEX.

Descriptors: *Forecasting, *Crop production, *Salinity, *Irrigation water, *Water requirements, Evaluation, Irrigation efficiency, Consumptive use, Crop response, Soil-water-plant relationships, Salt tolerance, Water quality, Soil chemical properties, Leaching, Alfalfa, Barley, Cotton, Sorghum, New Mexico, Arid lands, Cron (Field), Economic feasibility, Saline water, Saline soils, Irrigation effects, Depth, Root zone.
Identifiers: *Maximum crop production, *Salinity-water effects, *Adverse water, Leaching requirement, Pecos Valley (New Mexico).

Reduced Pecos Valley (eastern New Mexico) water supplies require economic maximization. Crops vary in water requirement and salt tolerance. Salinity is the principal factor that reduces crop yield. This study uses data on salt tolerance and water requirement of alfalfa, barley, corn, cotton and sorghum to estimate the effect on crop yields. Those estimates provide the basis for economic evaluation of crop, amount and salinity of water. Assumptions were: (1) soils permit leaching; (2) initial soil salinity does not determine equilibrium salinity; (3) soil depth does not determine average soil salinity; (4) 10 percent of the applied water drains out of the root zone; (5) electrical conductivity of the drainage water is twice that of soil saturation; (6) adverse water and salinity affects are additive; (7) salinity-water yield reduction is independent of inherent soil productivity; (8) irrigation is surficial; and (9) precipitation reduces salinity. Average soil salinity, salt tolerance, water requirement, salinity-water effects on yield, and maintenance of maximum yields are enumerated. Tables show salinity with irrigation amounts, and salinity-water effect on 5 crops. Curves present salinity-water application, effect and maximization on 5 crops. (Popkin-Arizona)
W71-01299

3D. Conservation in Domestic and Municipal Use

GEOLOGY FOR PLANNING AT CRESCENT CITY, ILLINOIS.
Illinois State Geological Survey, Urbana.

Robert E. Bergstrom, Compiler. Illinois Geological Survey Environmental Geology Notes, No 36, September 1970. 15 p, 5 fig, 7 ref.

Descriptors: *Geology, *Groundwater, *Planning, *Construction, Foundations, Water supply, Aquifers, Bedrock, Artesian wells, Water quality, Solid wastes, Septic tanks, Geologic mapping, Flood plains, Particle size.
Identifiers: Gas-storage reservoir, Lake sediments, Tables.

On the morning of June 21, 1970, the village of Crescent City, Illinois, about 75 miles south of Chicago, was heavily damaged by explosions and fires from 11 railroad tank cars containing propane in a train that derailed within the village limits. This report is the result of a request, following the catastrophe, from the Illinois State Department of Local Government Affairs to assess the municipal conditions at Crescent City and prepare a plan for rebuilding the village. The results of the study show that lake sediments in the northern and western halves of the region are generally fine-grained and tight, so that they do not yield water rapidly to excavations, even though the water table is relatively shallow. For the same reason, they do not accept fluids rapidly and are not well suited for the operation of septic tank fields. They should provide reasonably sound foundation materials and, along with the underlying tills, should afford protection to underlying aquifers where solid waste disposal is planned. Groundwater for present demands in the area has been generally available from sand and gravel aquifers at the base of the glacial drift. The bedrock except for the uppermost formations is generally not favorable for development of groundwater supplies because much of the deeper water is too highly mineralized for most purposes. An important geological feature of the area is the gas-storage structure between Crescent City and Watseka. (Woodard-USGS)
W71-01111

3E. Conservation in Industry

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM.
Garver and Garver, Little Rock, Ark.
For primary bibliographic entry see Field 06B.
W71-01166

FLORIDA EX REL MYERS V CONE (LEASING SALT WATER BEDS).
For primary bibliographic entry see Field 06E.
W71-01447

3F. Conservation in Agriculture

A RECONNAISSANCE OF THE WATER RESOURCES IN THE PORTNEUF RIVER BASIN, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 02E.
W71-01104

THE HYDRAULIC FILTER LEVEL OFFSET METHOD FOR THE FEEDBACK CONTROL OF CANAL CHECKS; COMPUTER PROGRAM FOR SYSTEM SIMULATION,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01130

THE NATURE AND DISTRIBUTION OF FARMING IN NEW YORK STATE,
New York State Office of Planning Coordination, Albany.
Howard E. Conklin, and Robert E. Lintron.
Available from NTIS as PB-190 477, $3.00 in paper copy, $0.95 in microfiche. December 1969. 36 p.
Identifiers: *Agriculture, Distribution, *Economics, New York, Labor, Actual photographs, Volume, Production, Terrain, Soils, Climatology, Water supplies, Commerce, Transportation, Budgets, Agricultural economics.

The report analyzes commercial farming in New York State and poses questions to be considered in relating farming to planning and development plans on local, regional and state levels. The economic viability of farm areas--each farm having been appraised and classified through air photos or staff inspection--is illustrated by a 45 x 38 inch map. While commercial farming occupies one-third of the state's land now, only 15 percent is identified as having high viability and another 15 percent moderate viability, taking into consideration such factors as soil, topography, climate, water resources, location, markets, transportation, farm investment, farming skills, technology, competition, urban influences and government policies. The study shows the number of farms has been decreasing but farm size and total output have increased, and the trend will likely continue.
W71-01133

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME II.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06E.

W71-01185

THE INFLUENCE OF INADEQUATE WATER SUPPLY ON METABOLISM IN BIOLOGICAL SYSTEMS WITH EMPHASIS ON PROTEIN SYNTHESIS AND NUCLEIC ACID METABOLISM,
Florida Univ., Gainesville. Water Resources Research Center.
For primary bibliographic entry see Field 02I.
W71-01191

RELATIONSHIPS BETWEEN PESTICIDAL APPLICATION AND WATER CONTAMINATION UNDER IRRIGATION IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 05B.
W71-01195

EXPERIENCE WITH THE MATHEMATICAL MODEL OF THE HYDRAULIC NETWORK OF RIJNLAND WATER BOARD,
Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 06A.
W71-01227

SOIL WATER AND TREE GROWTH IN A GREAT PLAINS WINDBREAK,
Forest Service (USDA), Rlincoln, Neb., Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
W71-01280

FERTILIZATION OF THE GREGG VARIETY OF COTTON UNDER IRRIGATION AT THE NORTHEASTERN BRANCH STATION,
New Mexico State Univ., University Park; and New Mexico Agricultural Experiment Station, University Park.
David Williams, and V. H. Gledhill.
Research Report 151, June 1969. 8 p, 8 tab.

Descriptors: *Fertilization, *Cotton, *Crop production, *Plant growth, Nitrogen, Phosphorous, Potassium, Irrigable land, New Mexico, Arid lands, On-site tests, Data collections, Fibers (Plant), Analysis.
Identifiers: *Gregg variety (Cotton), *Irrigated crop, Tucumcari (New Mexico).

This study was conducted to determine whether irrigated cotton yields in Tucumcari, New Mexico, area could be consistently increased by the proper use of nitrogen, phosphorous and potassium fertilizers. Tests were run on the Gregg cotton variety in 1964, 1965 and 1966. A skip-row method of planting with two rows of cotton and two unplanted rows was used. A factorial experiment and a no-fertilizer check was used. Nitrogen (ammonium nitrate) at 30, 60, 90 or 120 pounds N per acre, phosphorous (treble superphosphate) at 0, 20 and 40 pounds P per acre and potassium (Muriate of potash) at 0 and 29 pounds K per acre were applied. Eight fiber characteristics were determined. A statistical analysis of the 3-year data was made. The test data suggest that variable response to fertilizer will be obtained from cotton. Rate limits for nitrogen and phosphorous appear to be 60 and 40 pounds per acre of N and P respectively. Potassium in the soil appears adequate for cotton under experimental conditions. Tables show cultural practices, climatic conditions, mean and yearly yields of Gregg variety by fertilizer and yearly fiber analysis. (Popkin-Arizona)
W71-01287

PLANTING DATES FOR IRRIGATED GRAIN AND FORAGE SORGHUMS AT THE NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
David H. Williams.
New Mexico Agricultural Experiment Station Bulletin 544, January 1969. 12 p, 10 tab.

Descriptors: *Planting management, *Sorghum, *Grains, *Forages, *Crop production, Irrigation, Plant growth, New Mexico, Arid lands, On-site tests, Data collections, Timing, Mature growth stage, Growth stages, Silage.
Identifiers: *Planting dates, *Irrigated crops, *Optimum yields, *Late-maturing hybrids, *Northeastern Branch Station (New Mexico), Tucumcari Irrigation Project (New Mexico).

This 1963-66 study was initiated to determine the influence of planting dates on irrigated grain and forage sorghums for producers on the Tucumcari Irrigation Project. Three hydrids representing early, medium and late maturity were used. Highest forage yields were obtained with a late-maturing hybrid, Lindsey 101F. Highest grain yields were obtained with the same late-maturing hybrid planted in mid May, Lindsey 101F. The 1965 trials were lost. If both high silage and high grain yields are desired, the data suggests a late-maturing hybrid should be planted by mid May. Early plantings of grain and forage sorghums avoided serious midge damage. Tables show cultural and climatic conditions of irrigated trials, yield and related data for different planting dates. (Popkin-Arizona)
W71-01293

GRAZING VS. WHEAT PRODUCTION ON MARGINAL UTAH CROPLAND,
Utah State Univ., Logan. Dept. of Range Science.
John P. Workman, and Jack F. Hooper.
Utah Science, Vol 29, No 2, p 32-33, 60, June 1968. 2 tab, 2 photo.

Descriptors: *Range management, *Economic feasibility, *Cost analysis, *Grasslands, *Grazing, Wheat, Forages, Cattle, Dry farming, Drought resistance, Water loss, Utah, Arid lands, Return (Monetary), Livestock, Investment, Cover crops, Grasses.
Identifiers: *Livestock production, *Perennial grass, *Marginal cropland, *Synthetic budgets, *Economic loss, Permanent cover, Cash cost, Soil loss, Animal unit month (AUM), Losses (Monetary).

Many acres of Utah's marginal dry farm cropland were converted from wheat production to a permanent cover of drought tolerant perennial grasses under the Soil Bank Conservation Reserve Program of 1956. Many farmers in 1970 will be permitted to leave the released land in permanent cover for grazing or to return the land to wheat production. Data on potential livestock or wheat production, livestock and wheat production costs and break-even prices of livestock and wheat by operation size are investigated. Plans for a detailed study are discussed. Per acre costs, returns and investments are $1.84, $7.28 and $65.55 for forage production and $28.50, $7.94 and $153.40 for wheat production. As seen from these synthesized budgets, both enterprises yield a pure economic loss. Ignoring machinery depreciation and other implicit costs, wheat production provides a higher return above case cost than forage production. Costs of soil and water losses, labor, investment interest, depreciation and improvemenets are generally not considered. Tables include forage and wheat production budgets. Photos show land in wheat and forage production, and wheat-production machinery. (Popkin-Arizona)
W71-01297

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 03C.
W71-01299

THE ECONOMIC POSSIBILITY OF ADAPTING NEW TECHNOLOGY IN SPRINKLER IRRIGATION TO THE GREEN RIVER BASIN,
Wyoming Univ., Laramie. Div of Agricultural Economics.
Richard J. Taggart.
Master of Science Thesis, Division of Agriculture Economics, University of Wyoming, Oct. 1969. 68 p, 27 tab, 8 fig, 15 ref. OWRR Project A-001-WYO (27).

Descriptors: *Sprinkler irrigation, Irrigation efficiency, Budgeting, Cost comparisons, Surface irrigation, Wyoming.
Identifiers: *Green River Basin, Seedskadee Pilot Farm.

The relative advantages are discussed of employing sprinkler type irrigation systems as compared to surface systems in the Green River Basin in southwestern Wyoming. Using the budgeting method of analysis, the costs for installing and operating two types of sprinkler systems, namely hydraulic and electric, are compared to the costs of surface irrigation. The author concludes that sprinkler irrigation, although requiring higher operational and maintenance costs, is more economic to use than surface irrigation because the increase in yields from sprinkler irrigation raises net income substantially. (Holmes-Rutgers)
W71-01350

UTILITIES: NEW TECHNIQUES, AND THEIR APPLICATION TO THE MUSKEGON COUNTY AREA, A WORKING PAPER REPORT.
Sheafer (John R.) and Associates, Wheaton, Ill.
For primary bibliographic entry see Field 05D.
W71-01372

IRRIGATION TIMING AND AMOUNTS,
MacQuarie Univ., Sydney (Australia).
E. T. Linacre, and M. R. Till.
J Aust Inst Agr Sci, Vol 35, No 3, p 175-196, Sept 1969. 22 p, 269 ref.

Descriptors: Irrigation, *Irrigation efficiency, Irrigation water, *Irrigation practices, *Timing, Moisture stress, Soil moisture, *Rates of application, Evaporation pans, Atmometers, Water delivery, Water requirements, Bibliographies.
Identifiers: *Water budget, *Available moisture capacity, Irrigation requirement, Evaporimeters, Pan evaporation.

Irrigation water should be applied at the right time and in the proper amount to maintain crop growth and produce maximum crop yields. Skilled farmers' decisions on timing and amount of irrigation may produce the same yields as calculated timing. The shortage of water and greater emphasis on crop quality may require increasingly sophisticated farming with more exact irrigation timing. This review deals with the determination of when irrigation is due, particularly by the use of soil-moisture tension meters or sorption blocks, or by water budgeting. The instruments show indirectly when the crop suffers water stress, are useful for high-value crops, and are simple and suitable for farm use. Water budgeting involves keeping a running tally of inputs and losses of water from the soil within the root zone; the crop is watered when the balance of moisture in the soil falls below some critical value. Several approximations are involved, making it unnecessary to estimate crop evaporation with great accuracy. This component of the budget can be derived from measurements with an evaporimeter or atmometer or from some formula such as the Penman. Accounts are given of advisory schemes, operated by central agencies in various parts of the world, to aid the farmer in planning irrigation timing and amounts. (USBR)
W71-01386

PERFORMANCE OF WINTER WHEAT VARIETIES UNDER DRYLAND AND IRRIGATED

CONDITIONS, PLAINS BRANCH STATION, 1959-1966,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01396

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01397

PLEISTOCENE NICHES FOR ALIEN ANIMALS,
Arizona Univ., Tucson. Dept. of Geochronology.
Paul S. Martin.
From a symposium 'Pleistocene Man-Environmental Relationships', held at VIIth Congress of the International Association for Quaternary Research (INQUA), Boulder, Colorado, 1965. BioScience, Vol 20, No 4, p 218-221, 15 February 1970. 2 fig, 2 tab, 22 ref.

Descriptors: *Pleistocene epoch, *Herbivores, *Niches, *Arid land, *Productivity, Ecosystems, Habitats, Mammals, Xerophilic animals, Ruminants, Big game, Xerophytes, Wildlife management, Ecology, Shrubs, Biological communities, Range management, Arizona, Biomass, Mexico.
Identifiers: *African herbivores.

Recent studies in a typical Arizona desert shrub community showed that of a productivity of 1400 kg/ha/yr, 900 kg/ha were inedible for cattle. Five times as many cattle were supported on an adjacent grassland with about the same precipitation, even though the productivity of the desert shrub community was greater. Clearly the cow, a grass-preferring, water-dependent herbivore is ill-adapted to western ranges which have little of either. The author argues for selective, careful studies on the introduction of African herbivores to these arid areas. In answer to the objection that they may wreak ecological destruction, owing to their lack of adaptation to these areas, several points are made: (1) the past biomass of the southwest was much greater than it is now; (2) during the Pleistocene, a wave of extinctions occurred; (3) these extinctions were mainly large herbivores closely related or identical to extant African herbivores, (4) the vacated niches have never been filled and (5) introduction of at least some of these animals into the southwestern U.S. may very well be into niches for which they are preadapted. A plea is therefore made for conservation of potentially useful African animal gene banks. (Casey-Arizona)
W71-01402

SELECTIVE CONTROL OF PLAINS PRICKLYPEAR IN RANGELAND WITH HERBICIDES,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 03B.
W71-01408

SOIL MOISTURE AND EFFECTIVENESS OF PREEMERGENCE HERBICIDES,
Illinois Univ., Urbana; and Danville Junior Coll., Ill.
For primary bibliographic entry see Field 02I.
W71-01409

SPECTRAL SURVEY OF IRRIGATED REGIONAL CROPS AND SOILS ANNUAL REPORT, 1 OCT. 1968-30 SEP. 1969.
Agricultural Research Service, Weslaco, Tex.
For primary bibliographic entry see Field 07B.
W71-01539

HYDRAULICS OF LOW-GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 02G.
W71-01545

HEARINGS AND REPORT ON DRAINAGE OF WETLANDS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
For primary bibliographic entry see Field 06E.
W71-01636

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MAN, AND STREAMFLOW MODIFICATION,
Oregon State Univ., Corvallis. Water Resources Research Inst.
John C. Campbell.
Paper No 69-216 presented at 1969 Annual Meeting American Society of Agricultural Engineers, Purdue Univ., W Lafayette, Indiana, June 22-25, 1969. 13 p, 5 fig, 2 ref. OWRR Project No A-001-ORE (4).

Descriptors: *Regulated flow, *Streamflow, *Water demand, *Human population, *Water supply, Water shortage, Rivers, Reservoirs, Water yield, Flood control, Flow augmentation.
Identifiers: Seasonal rainfall.

This presentation deals with Man and his fresh water supply, its shortages and excesses, and concerns more specifically the modification of streamflow to bring about a more timely distribution of water for the benefit of mankind. The problem is not concerning water per se but the involvement of people-caused water situations resulting from increasing occupance of the earth's surface in concentrated and often unplanned patterns. The problem is identified as one of water shortages and water excesses with occurrences of both on a seasonal basis appearing in most geographic areas. Since our hydrologic patterns do not change greatly over the centuries, the increasing problems must be the responsibility of Man himself, his changing habits, growing numbers, urbanization, technological advances, and the like. The author concludes that high reservoir systems for water storage can be utilized to retain 25 to 100 percent of annual water yield for later release. (Woodard-USGS)
W71-01114

SLOSS SHEFFIELD STEEL AND IRON CO V NANCE (LIABILITY FOR BLOCKING NATURAL DRAINAGE OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W71-01122

HAWKEYE PORTLAND CEMENT CO V WILLIAMS (EASEMENTS FOR WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-01123

EROSION AND RIPRAP REQUIREMENTS AT CULVERT AND STORM-DRAIN OUTLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08A.
W71-01126

SHEMMEL V KRAMER (LIABILITY FOR DIVERSION OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01134

CREECH V UNITED STATES (IMPERVIOUS LEVEE NOT THE CAUSE OF OVERFLOW AND INCREASED WIND TIDES).
For primary bibliographic entry see Field 06E.
W71-01138

PERE MARQUETTE RY V SIEGLE (LIABILITY FOR INTERFERENCE WITH ICE BUSINESS BY DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-01150

ZAMANI V OTTER TAIL POWER CO (STATUTE OF LIMITATIONS FOR FLOOD DAMAGE ACTIONS).
For primary bibliographic entry see Field 06E.
W71-01153

PAHL V LONG MEADOW GUN CLUB (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD).
For primary bibliographic entry see Field 06E.
W71-01155

SMITH V GEORGIA POWER CO (LIABILITY FOR FLOODING OF FARM BY OVERFLOW OF DAM).
For primary bibliographic entry see Field 06E.
W71-01158

EROSION PROTECTION FOR THE OUTLET OF SMALL AND MEDIUM CULVERTS,
South Dakota State Univ., Brookings.
Fred M. Chang, and Mansour Karim.
Available from NTIS as PB-190 565, $3.00 in paper copy, $0.95 in microfiche. February 1970, 52 p.
Identifiers: *Roads, Drainage, *Erosion, Control systems, Feasibility studies, Gravel, Walls, Model tests, Fluid flow, Design, Culverts, Scour, Stilling basins.

The study is conducted as a pilot study to investigate and evaluate the feasibility of an erosion control work for the outlet of small and median culverts. The proposed control work consists of a recessed stilling basin armored with gravel and a transverse impact wall. The primary objectives of the investigation were to find the dimensions of the stilling basin and a proper location of the impact wall for the design flow discharge for two tail water conditions; namely low tailwater condition simulating a discharge onto an open ground and high tailwater condition simulating a discharge into a receiving channel. Two things were of main concern: (1) no further deterioration of the basin that may initiate erosion on highway grade and finally it brings total failure, and (2) minimization of scour below the impact wall.
W71-01173

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART I. FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Lorenz G. Straub, and Loyal A. Johnson.
Available from NTIS as AD-703 392, $3.00 in paper copy, $0.95 in microfiche. Aug 1950, 173 p.
Identifiers: *Construction, Arctic regions, *Landing fields, Drainage, *Arctic regions, Landing fields, Structures, Design, Runways, Floods, Erosion, Pipes, Climatology, Rainfall, Intensity, Terrain, Maintenance, Military facilities, Rivers, Fluid flow, Ice, Alaska, Groundwater, Surface water runoff, Culverts.

The ultimate aim of the investigations and studies is the determination of design, construction, and maintenance procedures suitable for the drainage of airfields located in arctic and subarctic regions. The report is intended to summarize the outcome of a field investigation of selected sites in Alaska. (See also W71-01177)
W71-01176

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART II. TRANSLATIONS OF SELECTED TOPICS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Meir Pilch.
Available from NTIS as AD-462 973, $3.00 in paper copy, $0.95 in microfiche. April 1949, 148 p, Report, No 17. W-21-018-eng-430.
Identifiers: *Landing fields, Drainage, Moistureproofing, Abstracts, Processing, USSR, Permafrost, Soil mechanics, Engineering geology, Structural geology, Ice, Arctic region, Countermeasures, Reviews.

The report is a collection of translations of selected topics from three Russian sources and is composed of three parts. The first part, waterproofing and drainage of defense and nondefense structures, is an exact translation, including six chapters. The next part, abstracts of scientific research work for 1945. Obruchev Institute of Frost Science, also is an exact translation; it includes only that section of the original manuscript which contains the reports of the Institute of Frost Science. The last part, icings and countermeasures is a detailed abstract of the original text. (See also W71-01176)
W71-01177

USE OF STOCHASTIC HYDROLOGY TO DETERMINE STORAGE REQUIREMENTS FOR RESERVOIRS -- A CRITICAL ANALYSIS,
Stanford Univ., Calif. Program in Engineering Economic Planning.
For primary bibliographic entry see Field 06A.
W71-01188

CHANGES IN WATER ENVIRONMENT RESULTING FROM AQUATIC PLANT CONTROL,
Wisconsin Univ., Madison. Water Resources Center.
Grant Cottam, and Stanley A. Nichols.
Available from NTIS as PB-195 671, $3.00 in paper copy, $0.95 in microfiche. Technical Report OWRR B-019-Wis, Wisconsin Water Resources Center, July 1970. 27 p, 9 tab, 2 fig, 4 ref. OWRR B-019-Wis (2).

Descriptors: *Harvesting of algae, *Aquatic weeds, *Growth rates, *Shallow water, *Life cycle, Potamogeton, Vallisneria, Myriophyllum spicatum, Myriophyllum exalbescens, Filamentous algae, Macrophytes, Wisconsin.
Identifiers: University Bay (Wisc), Lake Mendota (Wisc), SCUBA equipment.

The effect of harvesting aquatic macrophytes was studied over a three year period by means of two plots, each 30 m by 30 m located in University Bay on Lake Mendota, Wisconsin. The plots were subdivided into nine compartments and were treated as follows: (1) Harvested 3 times, in June, July, and August; (2) Harvested twice; (a) in June and July; (b) in July and August; (3) Harvested once; (a) in June; (b) in July; (c) in August. These plots and their controls, were sampled four times, in June, July, August, and September. Sampling was done with SCUBA apparatus. The plants were cut six inches (15 cm.) above the bottom surface and were weighed and measured. The results indicate that one harvesting will reduce the amount of regrowth to about 50% of that of the controls, two harvests will result in about 75% reduction, and three harvests almost totally eliminated the plants for that year. Recommendations for harvesting heavily used areas are two harvests, one in mid June, and the other in July. August harvesting is not necessary in this climate, since the plants tend to break up regardless of treatment. None of the treatments had an appreciable effect on the subsequent years growth, even after two years of harvesting three times.
W71-01196

PROCESSING CHARACTERISTICS OF SUBSURFACE MACROPHYTES OF MADISON, WISCONSIN LAKES IN RELATION TO MECHANICAL HARVESTING SYSTEMS,
Wisconsin Univ., Madison. Water Resources Center.
D. F. Livermore, H. D. Bruhn, and B. W. Pollock.
Available from NTIS as PB-195 672, $3.00 in paper copy, $0.95 in microfiche. Technical Paper OWRR B-018-Wis, presented at IBP UNESCO meeting on Production, Ecology, and Hydrological Implications of Aquatic Macrophytes, Sept. 1-10, 1970, Rumania, 1970. 12 p, 12 fig. OWRR B-018-Wis (1).

Descriptors: *Aquatic weed control, *Harvesting of algae, *Dewatering, Harvesting rates, Compressing, Calorimeter tests, Processing harvested material, Mechanical harvesting, Wisconsin.
Identifiers: Madison, Wisconsin Lakes.

Equipment has been developed to harvest subsurface macrophytes to depths of one to one and one-half meters, thus freeing the lake subsurface for boating and other recreational purposes without seriously disturbing the vegetation and fish habitat at greater depth. To facilitate handling and reduce operating costs, research was conducted on numerous methods of vegetation processing. Two methods of processing were found to offer possibilities in converting aquatic vegetation to a state more readily handled and transported. Fluidizing by intensive chopping and grinding reduces the vegetation to a slurry which can then be handled and transported as a fluid. A second alternative is mechanically dewatering the vegetation by chopping and pressing. The fluid fraction is returned to the body of water while press residue is reduced to 12 to 16% of the original volume and 23 to 32% of its original weight. Approximately 90% of the original solids, 85% of the protein, 60% of the potassium, and 80% of the phosphorus present in the vegetation as harvested is removed in the press residue. The effects of returning the liquid fraction to the body of water are not known.
W71-01197

GARMANY V SOUTHERN RY (LIABILITY FOR DISCHARGE OF ACCUMULATED SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W71-01209

EXPERIENCE WITH THE MATHEMATICAL MODEL OF THE HYDRAULIC NETWORK OF RIJNLAND WATER BOARD,
Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 06A.
W71-01227

FLOOD FORECAST AND FLOOD CONTROL BY COMPUTER,
Ministry of Construction, Morioka (Japan).
Yoshiharu Ida, Tadashi Kiya, and Ken-ichi Sasaki.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 413-420, 1969. 8 p, 12 fig, 2 photo, 1 tab.

Descriptors: *Flood routing, *Reservoir operation, *Computer programs, *Water management (Applied), Digital computers, Analog computers, Flood control, Reservoirs, Routing, Flood forecasting, Streamflow forecasting.
Identifiers: Hybrid computers.

Digital computers are effective in flood forecasting in which flood control is by river dams. Flood forecasting using digital computers in the Kitakami River, Japan, is in practical use in control of streamflow, making flood forecasts, and dam control. Hybrid computer systems, combinations of the elements of the digital computer, and the elements of the analogue computer are also being used. (Knapp-USGS)
W71-01229

A STOCHASTIC MODEL TO SIMULATE MONTHLY RIVER FLOW SEQUENCES,
Osaka Univ. (Japan). Hydraulics Lab.
Akira Murota, and Toru Kanda.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Hyoto, p 163-170, 1969. 8 p, 7 fig, 2 tab, 3 ref.

Descriptors: *Synthetic hydrology, *Stochastic processes, *Streamflow forecasting, *Rainfall-runoff relationships, Sampling, Simulation analysis, Low flow, Peak discharge, Regression analysis, Hydrograph analysis.
Identifiers: Japan, Stochastic hydrology.

Stochastic analyses were performed of the monthly river flow records of 48 years in the Kizu River Basin, Japan. The Pearson Type III distributions provide a good fit. Normalization of the distribution functions of observed flows is used in preparation of subsequent studies of synthesis of river flow sequences. Stratified sampling techniques are applied in order to discriminate between serial correlations of high flows and of low flows of consecutive months. By use of the obtained statistical parameters of high-flow and low-flow population, 200 years of monthly river flows were sythesized. To verify the applicability of the proposed model, properties of synthesized river flow sequences were compared with those of the flow sequences observed and also synthesized by the usual linear regression mode. The proposed model replicated the persistency of low flows and randomness of high flows in good agreement with observations. (Knapp-USGS)
W71-01233

A NEW RATIONAL METHOD FOR CALCULATION OF MAXIMUM FLOOD DISCHARGE BY AMOUNT OF RAINFALL IN THE CATCHMENT,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01234

ASHLEY V HOLDBERT (LANDOWNER'S LIABILITY FOR ROCKSLIDE DAMAGE CAUSED BY FAILURE TO MAINTAIN CLEAR CHANNEL FOR NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01249

NOBLE V ECHO LAKE TAVERN, INC (RIGHT TO DRAW WATER AND TITLE TO LAKE BED: DEED INTERPRETATION).
For primary bibliographic entry see Field 06E.
W71-01269

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (EVIDENCE OF HIGH WATER MARK AND TITLE TO BEDS).
For primary bibliographic entry see Field 06E.
W71-01278

BULL V STATE (LOWER PROPRIETOR NOT LIABLE FOR GRADE CHANGES WHICH REPULSE SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01282

KELLOGG V ILLINOIS CENT RR (LIABILITY FOR OVERFLOW OF DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W71-01296

FLOOD PLAIN INFORMATION, TARRANT AND JOHNSON COUNTIES, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps of Engineers Flood Plain Report, June 1970. 29 p, 4 fig, 16 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Regional flood, Flood forcasting, Flood control.
Identifiers: *Flood records, *Village Creek (Tarrant and Johnson Counties, Tex), Standard project flood, Intermediate regional flood.

Flooding along Village Creek in Tarrant and Johnson Counties, Texas above Lake Arlington is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall runoff, historical flood heights, and other technical data. (Woodard-USGS)
W71-01329

STORM SEWER SYSTEMS, FACILITIES NEEDED, 1966-1975,
American Public Works Association, Chicago, Ill. Research Foundation.
Herbert G. Poertner.
American Public Works Association Research Foundation Report, May 1966. 46 p, 3 fig, 7 tab, 9 ref.

Descriptors: *Storm drains, *Sewers, *Sewerage, *Storm runoff, *Urbanization, *Investment, *Capital costs, *Construction costs, *Financing, *Expenditures, Public benefits, History, Annual costs, Land development, United States.
Identifiers: *Storm sewers, *Combined sewers, *Capital requirements, United States Congress.

Capital investments are reported in urban storm sewer systems in the United States, descriptions of trends, and estimates of annual capital needs during the decade 1966-1975. Statistical data were obtained in three surveys of urban areas made in 1965-1966 by the American Public Works Association. It was estimated that the total investment in storm sewers and comboined sewers is $22 billion, based on 1965 costs, and that $25 billion will be required to construct new sewers, increase capacities of existing systems, and separate combined sewers in some urban areas. Local governments are expected to expend $16 billion. Private land developers would expend $9 billion for storm sewers in newly developed urban areas. Funds required for drainage facilities along highways, and roads and at airports, are not included. Seven tables are included to categorize capital investments, expenditures, capital needs and sources of financing by states and population groups. The report was prepared for the Subcommittee on Economic Progress of the Joint Economic Committee of the United States Congress. The publication includes discussions of the characteristics, fundamentals, principles, performance standards, economic costs, construction costs, user charges, and benefits of storm sewer systems. (Poertner)
W71-01335

SOME EFFECTS OF URBANIZATION ON FLOODS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 04C.
W71-01336

MANITOBA HYDRO CHURCHILL RIVER DIVERSION, STUDY OF ALTERNATIVE DIVERSIONS, A MATHEMATICAL MODEL.
Underwood, McLellan and Associates Ltd., Winnipeg (Manitoba).

Report to Manitoba Hydro, April 1970. 109 p, 25 fig, 3 tab, 5 ref.

Descriptors: *Model studies, *Computer models, *Diversion, *Hydraulic models, *River flow, Hydromechanics, Hydraulic structures, Diversion structures, Reservoirs, Control structures, Hydrologic models, Hydraulic similitude, Regulated flow.
Identifiers: *River diversion, Churchill River, Nelson River, Canada.

This study was directed toward the determination of optimized costs of diverting flow at various rates from Canada's Churchill River into the Nelson River basin via the Rat and Burntwood Rivers. The physical system investigated included: three possible interconnecting reservoir sites, two possible diversion points, an overflow structure for level control at Granville Lake, and two control channels terminating at Notigi Lake. Diversion would be via Suwanne Lake by gavity flow, and/or via Rat River by gravity flow or pumping from South Bay. The optimization program included the potential losses in resource values that would result from the development of reservoirs and other related structures for the diversion, as well as the actual construction costs. The optimal solutions were to provide information conerning: (1) which reservoirs should be developed and to what extent, subject to various constraints; and (2) the live storages that would be needed for producing flow rates for the critical period hydrology. In the mathematical study, all non-linear functions were transformed into piece-wise linear functions of small intervals so that the essential features of non-linear functional representation were preserved. The separable programming technique and algorithm of the mathematical programming system of IBM/360 was used to handle non-linear separable functions. The computer program and three typical solutions from the operation of the model are included in the publication. (Poertner)
W71-01338

MINNIE CREEK DRAINAGE DIST V STREETER (ANNEXATION OF LANDS TO DRAINAGE DISTRICT).
For primary bibliographic entry see Field 06E.
W71-01356

QUALITY OF STORMWATER DRAINAGE FROM URBAN LAND AREAS IN NORTH CAROLINA.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 05G.
W71-01360

PERKINS V VERMONT HYDRO-ELECTRIC CORP (LIABILITY FOR FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01361

GRAHAM V SAFE HARBOR WATER POWER CORP (DURATION OF FLOOD RIGHTS).
For primary bibliographic entry see Field 06E.
W71-01362

MECHANICAL EQUIPMENT FOR FIELD DRAINAGE AND DITCHING,
Ministry of Agriculture, Fisheries and Food, London (England).
C. Culpin.
Work Pap No 51, AGRI/WP.2, Econ Comm Eur, Comm Agr Probl, Feb 1970. 36 p, 19 fig, 5 tab, append.

Descriptors: *Drainage practices, *Drainage systems, Drainage water, Drains, Drain tiles, *Drainage, Agriculture, *Foreign design practices, Trenches, Costs, Mole drainage, Mole drains, Ditches, Draglines, Excavators, Underdrains, Subsurface drains, Construction equipment, Irrigation operation and maintenance.
Identifiers: Great Britain, France, Drain spacing, Pipe laying, Open drains, Construction methods.

Drainage of individual agricultural fields is necessary in wet climates. This may be done either by an underground drain or open ditches, or by a combination of both. Mechanical equipment used for installing and maintaining farm drains is discussed. Drainage needs vary in different countries, but few fundamental differences exist in basic needs. Drainage practices of individual countries are summarized. Types of drains, such as clay tile, plastic pipe, concrete pipe, open ditches, timber box drains, mole drains, typical spacings and depths used, and method and machinery used for installation are reviewed. Installation and operating costs of farm drainage in Great Britain and France are given. (USBR)
W71-01380

PRESTON V CLARK (UPPER RIPARIAN OWNER'S RIGHT TO MAINTAIN DAM).
For primary bibliographic entry see Field 06E.
W71-01413

BROWN V STATE (CANAL CONSTRUCTION AS A CONTRIBUTORY CAUSE OF FLOODING).
For primary bibliographic entry see Field 06E.
W71-01424

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (RIPARIAN RIGHT TO DIVERT THE WATERS OF A NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-01425

BRAEBURN ALLOY STEEL CORP V UNITED STATES (GOVERNMENT'S LIABILITY FOR DAMAGES CAUSED BY UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-01429

RODEN COAL CO V UNITED STATES (GOVERNMENT'S LIABILITY FOR SUBSIDENCE DAMAGE CAUSED BY CHANNEL DREDGING).
For primary bibliographic entry see Field 06E.
W71-01430

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS).
For primary bibliographic entry see Field 06E.
W71-01436

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS).
For primary bibliographic entry see Field 06E.
W71-01438

STURGES V SCHOOL DISTRICT (LIABILITY FOR DIVERTING NATURAL FLOW OF WATER ONTO ANOTHER'S LAND).
For primary bibliographic entry see Field 06E.
W71-01461

SGARLATA V CITY OF SCHENECTADY (CITY'S LIABILITY FOR FLOOD DAMAGE

CAUSED BY STREAM BEING BACKED UP BY OBSTRUCTED CULVERT).
For primary bibliographic entry see Field 06E.
W71-01471

KEARNS V TOWN OF BLOOMFIELD (PRESCRIPTIVE RIGHT TO USE DRAINAGE DITCH OVER PRIVATE PROPERTY).
For primary bibliographic entry see Field 06E.
W71-01492

URBAN DRAINAGE AS A FACTOR IN EUTROPHICATION,
Public Health Service, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-01500

WATER PERMEABILITY OF FROZEN SAND,
Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
For primary bibliographic entry see Field 02G.
W71-01505

WATSON V CHESAPEAKE AND OHIO RY (RAILROAD'S LIABILITY FOR CHANGING SURFACE DRAINAGE BY ELEVATING TRACKS).
For primary bibliographic entry see Field 06E.
W71-01518

ST LOUIS SAN FRANCISCO RY V MANNING (RAILROAD'S LIABILITY FOR DESTROYING NATURAL PROTECTION FROM RIVER OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-01519

JOHNSON V RATLIFF (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01520

BARRILLEAUX V DELAUNE (LIABILITY FOR LEVEE OBSTRUCTING DRAINAGE SERVITUDE).
For primary bibliographic entry see Field 06E.
W71-01536

EFFECTS OF METHOD B BACKFILL ON FLEXIBLE CULVERTS UNDER HIGH FILLS: CHADD CREEK VOLUME 2 (APPENDICES),
California State Div. of Highways. Bridge Dept.
Raymond E. Davis.
Available from NTIS as PB-188 624, $3.00 in paper copy, $0.95 in microfiche. Cal. State Div. of Highways Report No R/D-4-69, October 1969. 354 p.
Identifiers: *Pipes, Drainage, *Roads, Structural properties, Flexible structures, Data, Foundations (Structures), Soil mechanics, Straw, Stresses, Strain (Mechanics), Moments, Thrust, Filling, Culverts, Corrugated metal pipes.

The volume contains appendixes of data, theoretical analysis and calculations of corrugated section properties.
W71-01540

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,
For primary bibliographic entry see Field 06E.
W71-01547

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01551

HEWITT V PERRY (REASONABLE USE OF RECREATIONAL EASEMENT).
For primary bibliographic entry see Field 06E.
W71-01563

BOWERS V PRICE (LIABILITY FOR INCREASE OF NATURAL FLOW BY DOMINANT ESTATE).
For primary bibliographic entry see Field 06E.
W71-01568

UNITED STATES V BIG BEND TRANSIT CO (TITLE TO CONDEMMED LAND ON INDIAN RESERVATION).
For primary bibliographic entry see Field 06E.
W71-01573

GARLAND LEVEE DIST V HUTT (LEVEE DISTRICT'S LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF LEVEE).
For primary bibliographic entry see Field 06E.
W71-01576

I. COMPREHENSIVE PLAN FOR THE FOX RIVER WATERSHED, CH 14 (SURVEY OF LEGAL ASPECTS OF WATERSHED DEVELOPMENT).
For primary bibliographic entry see Field 06E.
W71-01578

ROE V CITY OF MIDDLETOWN (MUNCIPALITY'S LIABILITY FOR DAMAGE RESULTING FROM FILLING OF CHANNEL).
For primary bibliographic entry see Field 06E.
W71-01579

HUMPICH'S TRUSTEES V LOUISVILLE GAS AND ELEC CO (POWER COMPANY'S LIABILITY FOR BACKWATER FLOODING CAUSED BY FEDERAL DAM PROJECT).
For primary bibliographic entry see Field 06E.
W71-01585

SHARP V LEARNED (BOUNDARY BETWEEN STATES WHEN THE RIVER THREAD CHANGES).
For primary bibliographic entry see Field 06E.
W71-01589

CAPLES V TALIAFERRO (OWNERSHIP OF SUBMERGED LANDS).
For primary bibliographic entry see Field 06E.
W71-01590

STRECKFUS STEAMERS, INC V FOX (RIGHT OF STATE TO TAX SALES ABOARD STEAMBOAT IN NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-01594

METZ V HOFFMAN (UNLAWFUL OBSTRUCTION TO STREAMFLOW).
For primary bibliographic entry see Field 06E.
W71-01600

WEST PENN RY V UMBEL (PROPERTY DAMAGE RESULTING FROM ROCK SLIDE; NEGLIGENT CONTAINMENT OF WATER).
For primary bibliographic entry see Field 06E.
W71-01601

COMMONWEALTH EX REL MARGIOTTI V DELAWARE DIV CANAL CO (CANAL OWNERSHIP AS AFFECTED BY BREACH OF COVENANT TO MAINTAIN AS A CANAL).
For primary bibliographic entry see Field 06E.
W71-01603

FURJANIC V METROPOLITAN EDISON CO (RELIEF FROM CANAL OVERFLOW BARRED BY LACHES).
For primary bibliographic entry see Field 06E.
W71-01604

STATE EX REL O'CONNOR V SORENSON (NEW PROPERTY BOUNDARY CAUSED BY NEW HIGH WATER MARK WHEN RIVER WAS DAMMED).
For primary bibliographic entry see Field 06E.
W71-01606

WILKINSON V CITY OF INDIANOLA (OVERFLOW OF CITY SEWAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01608

STATE V M SUPPLE AND SONS CO (STATE INTERFERENCE WITH CONSTRUCTION OF BULKHEAD NOT IN NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-01610

LATHAM V DES MOINES ELECTRIC LIGHT CO (WATER DAMAGE CAUSED BY BURSTING STORM SEWER).
For primary bibliographic entry see Field 06E.
W71-01611

HUERTH V TOWN OF PRAIRIE DU SAC (JURY QUESTION AS TO WHETHER STATUTORY REQUIREMENTS WERE MET RELATING TO PROPER DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01614

STATE V KNOWLES-LOMBARD CO (USE OF LAND BETWEEN HIGH AND LOW WATER MARKS).
For primary bibliographic entry see Field 06E.
W71-01616

CAHILL V MAYOR AND CITY COUNCIL OF BALTIMORE (PERMIT TO CONSTRUCT WHARF INTO NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-01617

GRAY V GRAY (VALIDITY OF LAND PATENTS UNDER NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.
W71-01618

STATE V MALMQUIST (DAM OWNER'S DRAWDOWN OF LAKE AS NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01622

HERSHEY BEVERAGE CORP V CITY OF SCHENECTADY (MUNICIPAL LIABILITY FOR FLOOD DAMAGES).
For primary bibliographic entry see Field 06E.
W71-01625

MAYO V WINDELS (DAMAGES FOR WATER DIVERSION).
For primary bibliographic entry see Field 06E.
W71-01626

APPLICATION OF GILLESPIE (COMPENSATION TO NEIGHBORING LANDOWNER FOR CONSTRUCTION OF AQUEDUCT).
For primary bibliographic entry see Field 06E.
W71-01627

ROCKLAND LIGHT AND POWER CO V CITY OF NEW YORK (DAMAGES PRESENTLY RECOVERABLE AS DEDUCTIBLE FROM TOTAL DAMAGES SUFFERED BY WATER DIVERSION).
For primary bibliographic entry see Field 06E.
W71-01628

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONGRESS, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01633

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT--WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
For primary bibliographic entry see Field 06E.
W71-01635

BRADLEY V CITY OF MARLBORO (CITY'S LIABILITY FOR FLOODING CAUSED BY IMPROPERLY MAINTAINED CULVERT).
For primary bibliographic entry see Field 06E.
W71-01638

LYON V CITY OF BINGHAMTON (CITY'S LIABILITY FOR DIVERTING WATER AND FOR TAKING POSSESSION OF MILLDAM).
For primary bibliographic entry see Field 06E.
W71-01639

TALBERT V CITY OF WINCHESTER (FLOOD DAMAGE FROM DIVERTED SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01641

CITY OF COVINGTON V MCKINNEY (OBSTRUCTION CAUSING OVERFLOW AS PERMANENT WHERE NOT REMEDIABLE AT REASONABLE EXPENSE).
For primary bibliographic entry see Field 06E.
W71-01642

DAVIS V IVEY (LIABILITY FOR ALTERING FLOW OF SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-01649

4B. Groundwater Management

A RECONNAISSANCE OF THE WATER RESOURCES IN THE PORTNEUF RIVER BASIN, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 02E.
W71-01104

THE USE OF LINEAR PROGRAMMING FOR ESTIMATING GEOHYDROLOGICAL PARAMETERS OF GROUNDWATER BASINS,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01193

MODELTESTS INVESTIGATING THE POSSIBILITIES OF ARTIFICIAL WATER STORAGE IN ALLUVIAL GROUNDS,
Stuttgart Univ., (West Germany).
Gunter W. Marotz.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 231-238, 1969. 8 p, 7 fig, 1 tab, 4 ref.

Descriptors: *Hydraulic models, *Infiltration, *Artificial recharge, *Injection wells, Flooding, Water spreading, Water management (Applied), Alluvial channels, Hydraulic similitude, Water storage, Conjunctive use, Underground storage.
Identifiers: Underground reservoirs.

The problems of underground water storage in alluvium were analyzed with the help of two hydraulic models. Observations over two years, which included repeated fillings and drainages, gave results on the percentage of the soil volume which can be filled with water. This percentage is a function of the soil structure, of atmospheric pressure, temperature, and other parameters. It was found that the air occlusions which become trapped in voids cause the main difficulties. Flood waters (which are particularly suited for filling underground reservoirs) often carry excessive amounts of suspended load, but the importance of underground storage as a means for water supply should not be underestimated. (Knapp-USGS)
W71-01216

MATHEMATICAL MODEL OF THE BIG BEND WELL FIELD,
Southwestern Ohio Water Co., Cincinnati; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-01236

WATER LAW IN SOUTHEASTERN WISCONSIN.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (RIPARIAN AND DIFFUSED SURFACE WATER LAW).
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01550

4C. Effects on Water of Man's Non-Water Activities

BULL V STATE (LOWER PROPRIETOR NOT LIABLE FOR GRADE CHANGES WHICH REPULSE SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01282

SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM.
Kaiser Engineers, Oakland, Calif.
For primary bibliographic entry see Field 05G.
W71-01333

SOME EFFECTS OF URBANIZATION ON FLOODS,
Illinois State Water Survey, Urbana.
John B. Stall, Michael L. Terstriep, and Floyd A. Huff.
Meeting Preprint 1130, a paper presented at the ASCE National Water Resources Meeting, Memphis, Tenn., January 26-30, 1970. American Society of Civil Engineers, New York, January 1970. 29 p, 11 fig, 10 tab, 22 ref.

Descriptors: *Surface runoff, *Storm runoff, *Rainfall-runoff relationships, *Peak discharge, *Urbanization, *Maximum probable flood, Unit hydrographs, Hydrograph analysis, Runoff, Model studies, Drainage effects, Floods, Illinois, Streamflow forecasting, Drainage water, Permeability, Design storm, Design flood, Illinois, Cities.
Identifiers: *Effects of urbanization, Impervious area.

The objectives of the study were: (1) to attempt a better definition of the effects of urbanization on floods by using relatively good information available in Illinois on storm rainfall structure and frequency, and (2) to translate this into the resulting effect on the flood-frequency curve using a set of empirical equations developed in 1965 at the University of Texas Center For Research in Water Resources by Espy, Morgan, and Masch (A Study of Some Effects of Urbanization on Storm Runoff from a Small Watershed CRWR Technical Report HYD 07-6501 Austin, Texas 1965). The Texas equations were used as a transfer function from storm rainfall to flood peak. A model two-hour rainstorm, based on recorded precipitation data from East-Central Illinois, was developed for various recurrence intervals and applied to the completely urbanized, 3.5-square mile drainage area of Boneyard Creek at Urbana, Illinois. The specified model storm was applied to the derived unit hydrographs after determining the rainfall excess after losses. The empirical Texas equations seem adequate to produce a 30-minute unit hydrograph for the Boneyard basin and it checks favorably with actual unit hydrographs. The complete transformation of a 3.5-square mile rural basin, in East-Central Illinois, to an intensely urbanized basin would quadruple the flood peak for the 50-year recurrence interval; and the mean annual flood would increase by about eight times. (See also W69-02354). (Poertner)
W71-01336

THE EFFECT OF LAND UTILIZATION ON WATER QUALITY VARIATIONS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 05B.
W71-01345

SPECIAL CASES OF WATER SUPPLY INTERFERENCE CAUSED BY URBAN DEVELOPMENT NEAR TORONTO, ONTARIO, CANADA,
Ontario Water Resources Commission, Toronto.
For primary bibliographic entry see Field 02F.
W71-01363

VARIATION OF URBAN RUNOFF WITH DURATION AND INTENSITY OF STORMS,
Texas Tech Univ., Lubbock. Water Resources Center.
For primary bibliographic entry see Field 05B.
W71-01546

SMITH V STATE (VALUATION OF PROPERTY CONDEMNED FOR HIGHWAY RELOCATION AND FLOOD CONTROL PROJECT).
For primary bibliographic entry see Field 06E.
W71-01629

4D. Watershed Protection

EFFECTS OF SIMULATED CLOUD SEEDING ON STREAMFLOW OF SELECTED WATERSHEDS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 03B.
W71-01116

DESIGN CRITERIA FOR CONTROLLED SCOUR AND ENERGY DISSIPATION AT CULVERT OUTLETS USING ROCK AND SILL,
South Dakota School of Mines and Technology, Rapid City.
For primary bibliographic entry see Field 08B.
W71-01119

WATERSHED MANAGEMENT AND SOIL EROSION PROBLEMS IN WEST PAKISTAN,
For primary bibliographic entry see Field 02J.
W71-01400

ON THE BIOLOGY OF THE DESERT TORTOISE TESTUDO SULCATA IN SUDAN,
Khartoum Univ. (Sudan). Dept. of Zoology.
For primary bibliographic entry see Field 02I.
W71-01404

MIAMI CORP V STATE (STATE OWNERSHIP OF PROPERTY OF LAND SUBMERGED BY EROSION AND SUBSIDENCE).
For primary bibliographic entry see Field 06E.
W71-01444

WATER LAW IN SOUTHEASTERN WISCONSIN.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (RIPARIAN AND DIFFUSED SURFACE WATER LAW).
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01550

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01551

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT OF THE COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 90th CONGRESS, 1st SESSION.
For primary bibliographic entry see Field 06E.
W71-01605

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT--WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
For primary bibliographic entry see Field 06E.
W71-01635

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

ECOLOGICAL STUDIES OF MARINE PLANKTON,
TRW Systems Group, Redondo Beach, Calif. Physical Research Center.
For primary bibliographic entry see Field 02L.
W71-01125

RADIOMETRIC DETECTION OF OIL SLICKS,
Aerojet-General Corp., El Monte, Calif.
A. T. Edgerton, and D. T. Trexler.
Available from NTIS as AD-702 402, $3.00 in paper copy, $0.95 in microfiche. Report No SD 1335-1, Various pagings, January 1970. Contract DOT-CG-93,288A.
Identifiers: *Aerial reconnaisance, Water pollution, *Water, Pollution, *Radiometers, *Petroleum, Water, Detectors, Hydrocarbons, Fuel oil, Spectrum signatures, *Oil pollution, *Oil slicks, Microwave, Radiometry, *Remote sensing.

A study has been performed to assess the feasibility of using microwave radiometry for detection of oil pollution. The investigation stems from the U. S. Coast Guard's requirement for an airborne surveillance system which can detect oil pollution during inclement weather and during the hours of darkness. Laboratory and airborne measurements were made of a variety of oil base pollutants. Laboratory investigations included microwave response as a function of oil film thickness, physical temperature of the oil-water system, pollutant type sensor wavelength, antenna polarization, and observation angle. These studies consisted of dual-polarization radiometric measurements (observational wavelengths of 0.8cm and 2.2cm) of Bunker C fuel oil, gasoline, and 20, 30, and 40 API gravity crude oil. The dielectric properties of these pollutants were also measured by means of a 0.81 cm ellipsometer. The results of the laboratory measurements were used to select the most suitable microwave radiometer for the airborne measurements. The airborne measurements were of small oil slicks on the open ocean off the Southern California Coast. Measurements were made from an aircraft instrumented with a dual-polarized 0.81 cm radiometer oriented with a forward antenna viewing angle of 45 deg from nadir. Pollutants examined during the tests include marine diesel fuel; 20, 30, and 40 API gravity crude oils, and a mixture of diesel fuel and 20-gravity oil. Measurements were made under various atmospheric and low sea state conditions, including several at night.
W71-01144

NON-CHOLERA VIBRIOS OF EGYPTIAN SURFACE WATERS,
Naval Medical Research Unit No. 3, Cairo (Egypt).
For primary bibliographic entry see Field 05F.
W71-01161

ASSEMBLY AND EVALUATION OF AN IMPROVED PPB OXYGEN ANALYZER FOR SEAWATER,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W71-01201

DESIGN OF WATER QUALITY SURVEILLANCE SYSTEMS - PHASE I - SYSTEMS ANALYSIS FRAMEWORK,
NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.
Paul V. Morgan, Brownie R. Johnson, Henry C. Bramer, and Wallace L. Duncan.
Available from NTIS as PB-195 675, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. SOD I67.13/4: 16090DBJ 08/70. Water Pollution Control Research Series, 16090 DBJ 02/70. February 1970. 303 p, 5 tab, 14 fig, 2 append. FWQA Contract 14-12-476. FWQA Program 16090DBJ.

Descriptors: *Systems Analysis, *Water Quality, *Monitoring, *Legal Aspects, *Water Pollution, *Water Measurement, Water Quality Act, Water Quality Control, Water Quality Standards, Water Quality Criteria, Information Retrieval, Surveillance.
Identifiers: *Ohio River Basin, *Tennessee River Basin, Missouri River Basin, *Southeastern River Basins, *Systems Analysis Framework, Water Quality Monitors.

In order to accomplish the goals of the Water Quality Act of 1965, it is necessary to establish water quality surveillance systems throughout the nation. It is highly imperative that the individual systems developed by the various Federal, state, and interstate agencies be compatible and their data systems be interconnected. The various inputs and decisions necessary to accomplish this task are so complex that modern systems analysis techniques should be applied to insure that each of these water quality surveillance systems are developed and designed utilizing the same criteria. This study is the initial effort to apply systems analysis techniques to the solution of this problem. Three major river basins were selected for this study in order to identify the parameters common to any basin throughout the nation. The three basins were studied by: (1) reviewing the literature associated with their water quality characteristics; (2) on-site visits to the river basin areas; (3) comparative review of the interstate water quality standards and plans of implementation; and (4) legal considerations in surveillance program design. These tasks provided the input material to develop a systems analysis framework. The systems analysis framework was applied manually to select sites for water quality surveillance stations on the major streams studied within the three river basins.
W71-01264

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,
Westinghouse Ocean Research Lab., San Diego, Calif.
For primary bibliographic entry see Field 05C.
W71-01266

DISTRIBUTION OF ARSENIC IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
R. R. Ruch, E. Joyce Kennedy, and Neil F. Shimp.
Study No 4 of Lake Michigan bottom sediments studies. Illinois Geological Survey Environmental Geology Note 37, September 1970. 16 p, 19 fig, 2 tab, 10 ref.

Descriptors: *Arsenic compounds, *Sediments, *Lake Michigan, Sediment-water interfaces, Cores, Distribution patterns, Radiochemical analysis, Gamma rays, Carbon, Organic matter, Alluvium, Clays, Michigan, Illinois.
Identifiers: Core samples, Grab samples, Waukegan (Ill), Benton Harbor (Mich).

This is the fourth in a series of reports covering investigations of the geology and chemical composition of Lake Michigan sediments. Major chemical objectives of these investigations are to assemble data on the distribution of trace elements in Lake Michigan sediments and to determine which geochemical processes operating during sedimentation affect the distribution of trace elements. Radiochemical separation procedures were used to determine the arsenic content of 89 core and grab samples from southern Lake Michigan. Arsenic was found to accumulate within the upper, or most recently deposited, portion of most of these sediments in concentrations ranging from about 5 to 30

ppm. Areas with high arsenic content were identified from sediment-water interface samples taken west of Benton Harbor, Michigan; east of Waukegan, Illinois; and southwest of Grand Haven, Michigan. Deposition of fine-grained sediments containing appreciable quantities of organic matter occurs at all these locations. Amounts of arsenic observed in the uppermost portions of these sediments generally vary directly with the organic carbon content and are probably a result of man's activities in the watershed surrounding the lake. (Woodard-USGS)
W71-01325

A GRAPHICAL SUMMARY OF DISSOLVED-OXYGEN DATA FOR THE DELAWARE RIVER ESTUARY FOR WATER YEARS 1965-69,
Geological Survey, Harrisburg, Pa.
Charles F. Merk.
Geological Survey Open-file report, September 1970. 15 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Computer programs, *Dissolved oxygen, *Delware River Basin Commission, Water quality control, Statistical methods, Temperature, Data collections, Data processing, Estuarine environment.
Identifiers: *Computer techniques, Graphical summaries, Stream-quality objectives.

To provide the user of the Delaware River estuary with concise information on the DO condition during the 5-year period for comparison with recently adopted Delaware River Basin Commission stream-quality objectives, data from 5 water-quality monitors are summarized and graphed by a computer process. The computer technique is developed to show the daily DO conditions statistically, including maximum, mean, and minimum values. Graphical summaries define the 5-year range of DO data for each of the 122 3-day periods of the water year. Monitor locations and zones sampled are shown on a sketch map and tables give DO objectives by river zones and DO daily statistics at Bristol, Penn. Computer processing provides convenient handling of the large quantity of data used to prepare the graphical summaries. (Lang-USGS)
W71-01327

A CONTINUOUS MONITOR FOR HEXAVALENT CHROMIUM IN RIVER WATER,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W71-01515

WALKER BRANCH WATERSHED PROJECT PROPORTIONAL WATER SAMPLER DESIGN REPORT AND OPERATING MANUAL,
Oak Ridge National Lab, Tenn.
W. F. Johnson, and W. R. Miller.
Available from NTIS as ORNL-TM-2839, $3.00 in paper copy, $0.95 in microfiche. ORNL-TM-2839, 10 Feb 70. 21 p, 5 fig.
Identifiers: *Rivers, Samplers, Water, Flowmeters, Design, Calibration, *Water samplers.

An automatic sampler was designed and constructed to withdraw samples of water from flowing outdoor streams. The volume of sample withdrawn is automatically in volumetric proportion to the stream flow rate. These samples are collected and combined as a large composite sample for laboratory analysis. The frequency of sampling can be adjusted manually. The sampler system will also automatically switch to a fast sampling mode such as during a storm whenever the rate of increase of the stream flow rate exceeds a preset value. In this mode the system collects individual samples in volumetric proportion to the stream flow rate in up to 250 bottles, each 250 ml capacity, at a rate of up to four individual samples per minute. These samples are not combined.
W71-01522

5B. Sources of Pollution

MEDDOCK V NATIONAL TRANSIT CO (LIABILITY FOR POLLUTION OF SPRING BY LEAKAGE OF OIL FROM PIPELINE).
For primary bibliographic entry see Field 06E.
W71-01115

EVALUATION OF THE HAZARD OF BULK WATER TRANSPORTATION OF INDUSTRIAL CHEMICALS: A TENTATIVE GUIDE.
National Academy of Sciences-National Research Council, Washington, D.C.

Available from NTIS as PB-189 845, $3.00 in paper copy, $0.95 in microfiche. 1969. 25 p. Revised edition.
Identifiers: *Chemicals, *Shipping (Marine), *Hazards, Chemicals, *Water pollution, Shipping (Marine), *Toxicity, *Fire safety, Shipping (Marine), Flammability, Standards, Irritating agents, Poisons, Aquatic animals, Amines, Aromatic compounds, Halogenated hydrocarbons, Acetates, Ketones, Formaldehyde, Gases, Oils, Petroleum, Metalorganic compounds, Organic solvents, Fuels, Epichlorohydrin, Tetraethyl lead, Hydrofluoric acid, Acrylates, *Oil pollution, *Water transportation, *Hazardous materials.

The fire hazards, health hazards, water pollution, and reactivity of some 209 industrial chemicals are presented. The ratings put forth in the report represent the over-all potential hazard connected with the bulk water shipment of specified industrial chemicals. The ratings were prepared specifically to relect to the Coast Guard the hazards or absence of hazards in shipping chemicals in their present industrial grades in bulk by water. They are not intended to be used for any other purpose and they are not considered valid to estimate the degree of hazard of handling these chemicals in any other manner.
W71-01135

RADIOACTIVITY IN WATER: PROJECT RULISON,
Teledyne Isotopes, Palo Alto, Calif.
For primary bibliographic entry see Field 05G.
W71-01136

CONTAINMENT OF OIL SPILLS BY PHYSICAL AND AIR BARRIERS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
For primary bibliographic entry see Field 05G.
W71-01141

MERIWETHER SAND AND GRAVEL CO V STATE (POLLUTION OF STREAMS).
For primary bibliographic entry see Field 06E.
W71-01147

COMMONWEALTH V CITY OF NEWPORT NEWS (LEGISLATIVE POWER TO AUTHORIZE DISCHARGE OF SEWAGE).
For primary bibliographic entry see Field 06E.
W71-01165

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics Inc., Laurel, Md.
For primary bibliographic entry see Field 05G.
W71-01172

LITTLE V MARTIN FURNITURE CO (LIABILITY FOR CONTRIBUTING TO THE POLLUTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-01182

RELATIONSHIPS BETWEEN PESTICIDAL APPLICATION AND WATER CONTAMINATION UNDER IRRIGATION IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.
Herbert Knutson, A. M. Kadoum, T. L. Hopkins, T. L. Harvey, and G. F. Swoyer.
Available from NTIS as PB-195 670, $3.00 in paper copy, $0.95 in microfiche. Kansas Water Resources Research Institute Contribution No 45, August 1970. 18 p, 2 tab, 1 fig, 11 ref. OWRR Project B-007-KAN (1).

Descriptors: *Insecticides, *Irrigation, *Carbamate pesticides, *Organophosphorus pesticides, Aldrin, Dieldrin, Endrin, Heptachlor, Wells.
Identifiers: Residues, Smoky Hill River, Cedar Bluff Reservoir, Corn.

Soil and foliar applications of insecticides were made annually (1965-1969) at approximate maximum recommended rates to a 20-acre, irrigated corn field receiving 30 to 42 inches of moisture per year. In 1967, two additional benches were added, which received twice the normal amount of irrigation water and 10 to 20 times the amount of insecticides. Capped wells, from 6.5 to 71 feet deep, located on the berms between the benches, contained no residues at the 0.1 ppb level, indicating no vertical penetration from surface applications (penetration did not exceed 12 inches) and no lateral contamination of groundwater from adjacent land. Surveys of insecticide use, 1960-1969, indicated generally light application of insecticides throughout the District before irrigation started in 1963. The use of organophosphates and carbamates greatly increased, followed by decreased use of organochlorines. Surface water samples from the Smoky Hill River and the Cedar Bluff Reservoir also contained no residues at the 0.1 ppb level. Aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide, and DDE were infrequently indicated in surface waters at trace (ppt) levels. Detection of little or insignificant contamination of surface waters agrees with survey results indicating little use of organochlorine insecticides in the District. The results indicate that insecticides at recommended maximum rates for 5 year on a 20-acre field, and use on adjacent dry land and in the newly developed irrigation district, did not contaminate groundwater. (McKenna-Kansas State University)
W71-01195

LEACHATE MOVEMENT IN THE SUB-SOIL BENEATH A SANITARY LANDFILL TRENCH TRACED BY MEANS OF SUCTION LYSIMETERS,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
Burke E. Lane, and Richard R. Parizek.
Proceedings of the 2nd Mid-Atlantic Industrial Waste Conference, November 18-20, 1968, Drexel Institute of Technology, p 261-277, 1968. 17 p, 11 fig, 1 ref.

Descriptors: *Path of pollutants, *Leaching, *Landfills, *Garbage dumps, *Groundwater movement, Karst, Infiltration, Ion transport, Pennsylvania, Subsurface drainage, Water quality, Water pollution sources, Lysimeters.
Identifiers: State College (Penn), Sanitary Landfill drainage.

The landfill site lies about 2 miles northwest of State College. The landfilling operation is on steep hillsides. The tops of the valley walls are about 100 feet high and the slopes approach 40 degrees near the valley bottom. The valley bottom is a dry, underdrained karst stream bed. Groundwater exists under water table conditions at a depth of about 250 feet. The water quality monitoring system consisted of a 900 square-foot sheet of plastic to line the bottom of a landfill trench, a spreader pipe in an infiltration trench, and a protective housing. The soil water sampling devices consisted of 17 suction lysimeters installed at various depths in the soil beneath the landfill trench. Movement of a wave front of leachate-polluted soil water could be traced in the soil beneath the landfill trench. Severe

pollution of the soil water in the immediate vicinity of a landfill can result even though the landfill is not in direct contact with a water table and even before the refuse has become saturated to field capacity. (Knapp-USGS)
W71-01204

FURTHER CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 05E.
W71-01205

SIMULATION OF A RIVER THERMAL BEHAVIOR FROM DATA OBTAINED BY A CLASSICAL METEOROLOGICAL NETWORK (FRENCH),
Electricite de France, Chatou.
For primary bibliographic entry see Field 02A.
W71-01221

MONROE CARP POND CO V RIVER RAISIN PAPER CO (RIPARIAN PROPRIETOR'S RIGHT TO USE STREAM NOT ABSOLUTE).
For primary bibliographic entry see Field 06E.
W71-01231

OHIO STOCK FOOD CO V GINTLING (STREAM POLLUTION BY UPPER RIPARIAN HOG FARM).
For primary bibliographic entry see Field 06E.
W71-01237

MANHATTAN OIL CO V MOSBY (LIABILITY FOR POLLUTING STREAM BY ESCAPE OF SALT WATER FROM OIL WELL).
For primary bibliographic entry see Field 06E.
W71-01303

CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05E.
W71-01324

DISTRIBUTION OF ARSENIC IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05A.
W71-01325

FLOW GRAPH MODELS OF THERMAL PROCESSES,
Windsor Univ. (Ontario).
For primary bibliographic entry see Field 07B.
W71-01343

THE EFFECT OF LAND UTILIZATION ON WATER QUALITY VARIATIONS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Richard P. Tokarski.
New Jersey Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, Oct. 1970, 64 p, 7 tab, 19 fig, 20 ref, 2 append. FWPCA Grant WP-143.

Descriptors: *Water pollution, *Water analysis, *Land use, Water quality, Biochemical oxygen demand, Nitrates, Phosphates.

This is a study of the occurrence of pollution on Puff Brook, a small watershed in New Jersey which includes a comparison of the pollution effects from a variety of land uses. High dissolved oxygen levels resulting from large numbers of algae were found in a pond; a maintenance yard area contributed oil, grease and washings from farm equipment; a pasture was found to contribute fecal matter to the stream. Contrary to expections, a housing development did not exert a significant effect on water quality except during periods of runoff, and even then less than agricultural contributions. A further study was made to compare water quality data from this stream to that of tertiary waste treatment effluents, and the latter were found to be inferior, particularly as regards phosphates. (Whipple-Rutgers)
W71-01345

JOHNSON V CITY OF FAIRMONT (JOINT LIABILITY OF INDEPENDENT POLLUTERS).
For primary bibliographic entry see Field 06E.
W71-01414

CITY OF CINCINNATI V KIRK (CITY'S LIABILITY FOR POLLUTION FROM SEWAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01415

TICHENOR V WITHERSPOON (LIABILITY FOR DISCHARGE OF POLLUTANTS INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01416

OAKWOOD SMOKELESS COAL CORP V MEADOWS (LIABILITY FOR DAMAGE RESULTING FROM NORMAL OPERATION OF COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01432

HAMPTON V TOWN OF SPINDALE (DISCHARGE OF INDUSTRIAL WASTES INTO MUNICIPAL SEWER SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01437

THE SS NEA HELLIS (FINES FOR DISCHARGING OIL INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-01450

UNITED STATES V THE DELVALLE (UNINTENTIONAL WATER POLLUTION BY UNUSED FUEL OIL).
For primary bibliographic entry see Field 06E.
W71-01454

DOHANY V CITY OF BIRMINGHAM (DUTY OF CITY TO PROPERLY MAINTAIN SEWAGE DISPOSAL PLANT).
For primary bibliographic entry see Field 06E.
W71-01467

'APPARENT' ORGANOCHLORINE INSECTICIDE CONTENTS OF SOILS SAMPLED IN 1910,
Wisconsin Univ., Madison. Dept. of Soil Science.
B. E. Frazier, G. Chesters, and G. B. Lee.
Pesticides Monitoring Journal, Vol 4, No 2, p 67-70, 1970. 3 fig, 2 tab, 5 ref. OWRR B-016-WISC (9).

Descriptors: *Insecticides, *Soils, Degradation, Chromotography, Analysis, Aldrin, Heptachlor, Soil properties.
Identifiers: *Organochlorine insecticides, Heptachlor epoxide.

Archives of the Wisconsin University's (Madison) Department of Soil Science include many soil samples collected by soil surveyors between 1909 and 1911. These samples were stored in tightly sealed containers. Thirty-four of these samples were extracted with Skelly B:acetone azeotropic solution and analyzed by gas chromatography on 3 columns. The results of analyses have indicated the apparent presence of organochlorine insecticide residues which originated from indigenous soil constituents. Peaks corresponding to heptachlor epoxide on QF-1/OV-17 and to adrin on QF-1/DC-200 columns caused major interference with chromatographic determinations. (Wilde-Wisconsin)
W71-01478

DISTRIBUTION OF MERCURY IN NATURAL WATERS OF THE SOUTHERN SLOPE OF NORTHWESTERN CAUCASUS (IN RUSSIAN),
Severo-Kavkaeskogo Geologicheskogo Upravleniya, Laurskaya Gidrogeologichyeskaya Psartiya.
V. G. Baev.
Doklady Akademii nauk SSSR, Vol 181, No 5, p 1249-1251, 1968. 1 fig, 1 tab, 8 ref.

Descriptors: *Inorganic compounds, *Metals, Streams, Groundwater, Analysis, Statistical methods, Water pollution sources, Water properties, Geologic formations.
Identifiers: *Mercury, Dithizone method, Mercury deposits, Cretaceous formations, Jurassic formations, Northwestern Caucasus.

The content of mercury was determined in more than 7000 samples of stream and groundwaters in 1100 square kilometer area of the northwestern Caucasus. The determinations of mercury were performed directly in the field by the use of dithizone method. The results obtained for separate watersheds were subjected to statistical analyses. Concentrations of mercury ranged from 3 to 10 ppb. Investigations established several relationships in the distribution of mercury and revealed several new deposits of the metal. Mercury in the surface or subterranean waters is not necessarily an industrial pollutant. (Wilde-Wisconsin)
W71-01481

A CONTINUOUS MONITOR FOR HEXAVALENT CHROMIUM IN RIVER WATER,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
D. W. Alton.
Available from NTIS as BNWL-1168, $3.00 in paper copy, $0.95 in microfiche. October 1969, 49 p. AEC Research and Development Report BNWL-1168.
Identifiers: *Water pollution, *Chromium compounds, *Wastes industrial, *Chromium, *Colorimetric analysis, Chromium, Chromates, Monitors, Corrosion inhibition, Nuclear reactors.

A continuous monitor for hexavalent chromium was developed and placed in routine operation at the Automatic Columbia River Monitor Station (ACRMS), located at the 300 Area of Hanford, approximately 4 miles upstream from the nearest public water supply intake. Basically, the unit is commercially available equipment which uses a colorimetric method for continuous determination of Cr (plus 6) concentrations in river water. With a modified water filtration system and other changes, Cr (plus 6) in river water as low as 2 to 3 parts per billion can be measured reliably. A remote alarm system preset to actuate at a Cr (plus 6) concentration of 25 ppb, provides the necessary time interval to enable water plants downstream to discontinue intake.
W71-01515

MICROBIAL CONTAMINATION IN SPACECRAFT WATER SYSTEM.
Aircraft Porous Media, Inc., Glen Cove, N.Y.

Available from NTIS as N70-23897, $3.00 in paper copy, $0.95 in microfiche. Final Report for NASA Manned Spacecraft Center, Doc No H-1360-2, Mar 1970. NASA Contract NAS 9-9027.

Descriptors: Pollutants, Bacteria, Recirculated water.

Identifiers: Pseudomonas diminuta.

A study was conducted to determine the degree of microbial back contamination to be expected from the waste water to the potable water in the Apollo Command Module water system. The study shows that a bacteria removal filter is needed immediately upstream of the potable water tank or immediately upstream of the potable water outlet.
W71-01516

ORGANIC MATERIALS IN THE MARINE ENVIRONMENTS AND THEIR INTERACTIONS WITH SOME METAL IONS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
Elizabeth Koshy, and A. K. Ganguly.
Available from NTIS as BARC-402, $3.00 in paper copy, $0.95 in microfiche. Government of India, Atomic Energy Commission Report, BARC-402, 1969. 128 p, 60 ref.
Identifiers: *Amino acids, *Dissolving, *Organometallic compounds, *Sea water, *Trace elements, Metal ions, Sediments, Solubility, Barium, Iron, Niobium, Zirconium, Humic acid, Zinc, Manganese.

The processing of formation of dissolved organic matter, separation and identification of the amino acids, interaction of the dissolved organic matter with trace elements, and characterization of the sediment humus and its role in solubilization and pick up of trace elements in the sea were investigated. Methods used for concentrating dissolved organic substances from sea water were evaluated. The methods of concentration of dissolved organic matter from a C-14 laboratory culture raised in sea water medium and from natural sea water are described. The amino acids constituents from these concentrates are identified and compared with those in the hydrolysates of a marine sediment humic acid. The interaction of trace elements such as Mn, Zn, Ba, Fe, and Zr-Nb (radioactive tracers) with the dissolved organics present in the culture solution was studied. Preparation, purification, and characterization of humic acid separated from the coastal sea bed sediment are described in detail. The trace metallic element contents in a highly purified humic acid are investigated.
W71-01523

VARIATION OF URBAN RUNOFF WITH DURATION AND INTENSITY OF STORMS,
Texas Tech Univ., Lubbock. Water Resources Center.
Robert C. Brownlee, T. Al Austin, and Dan M. Wells.
Available from NTIS as PB-195 785, $3.00 in paper copy, $0.95 in microfiche. Texas Tech University Water Resources Center Interim Report No WRC-70-3, September 1970. 68 p, 12 fig, 30 tab, 10 ref. OWRR Project No B-064-TEX (1).

Descriptors: *Storm runoff, *Water pollution sources, Cities, Urbanization, Sewage treatment, Sewage disposal, Biochemical oxygen demand, Statistics, Data collections, Hydrologic data, Rainfall-runoff relationships.
Identifiers: Urban runoff, Combined sewers.

A great many cities transport raw domestic sewage to treatment facilities in the same sewer systems used to carry storm runoff from their streets. The storm runoff carried by these combined sewers, during even moderate rainstorms, can greatly exceed the capacity of municipal sewage treatment plants. This study was undertaken to determine the concentrations of pollutants carried by the storm runoff from a small residential watershed, and to consider the variations of pollutant concentrations with the duration of runoff. Surface runoff from rainstorms on the small residential watershed contains pollutant concentrations which vary in average and extreme values from storm to storm. Average total dissolved solids and nitrates as well as the average pH value of storm runoff are within the USPHS standards for drinking water, while solids concentrations and total alkalinity concentrations are in the range of those found in raw sewage influent. Average BOD concentration of the samples tested is approximately the same as that of secondary sewage treatment effluent. Regression and correlation analyses indicate a definite reduction in constituent concentrations with duration of runoff. Rainfall intensities, antecedent moisture conditions, storm movements, and other parameters also influence this relationship. (Knapp-USGS)
W71-01546

POLLUTION ABATEMENT FACILITIES--GRANTS AND LOANS FOR PRELIMINARY PLANNING.
For primary bibliographic entry see Field 06E.
W71-01553

LET THE POLLUTER BEWARE (LEGAL RAMIFICATIONS OF POLLUTION),
For primary bibliographic entry see Field 06E.
W71-01562

AIR AND WATER POLLUTION,
For primary bibliographic entry see Field 06E.
W71-01565

REGULATION OF POLLUTION BY MINE WASTES.
For primary bibliographic entry see Field 06E.
W71-01570

WHAT CONSTITUTES A VIOLATION OF THE PROHIBITION, IN THE OIL POLLUTION ACT OF 1924 (33 USC 431 ET SEQ), OF DISCHARGE OF OIL INTO NAVIGABLE WATERS AND ADJOINING SHORELINES,
For primary bibliographic entry see Field 06E.
W71-01575

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RECOVERY OF DAMAGES FOR CITY'S POLLUTION OF RIVER).
For primary bibliographic entry see Field 06E.
W71-01580

G L WEBSTER CO V STEELMAN (ABATEMENT OF STREAM POLLUTION CAUSED BY CANNERY).
For primary bibliographic entry see Field 06E.
W71-01582

UNITED STATES V CARROLL OIL TERMINALS, INC (ACCIDENTAL OIL LEAKAGE CAUSED BY STORM DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01595

THE WATUPPA (VESSEL LIABLE FOR DUMPING WASTE OUTSIDE AUTHORIZED AREA).
For primary bibliographic entry see Field 06E.
W71-01596

COMMONWEALTH V PHILADELPHIA AND READING IRON AND COAL CO (POLLUTION OF WATER SUPPLIES AS PUBLIC NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01599

PUBLIC SERV COMM'N V SINKING SPRING WATER CO (REQUIRING POTABLE WATER FROM SUPPLIER).
For primary bibliographic entry see Field 06E.
W71-01602

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RIPARIAN RIGHTS AND WATER QUALITY).
For primary bibliographic entry see Field 06E.
W71-01623

DU PONT RAYON CO V RICHMOND INDUSTRIES, INC (RIPARIAN RIGHT TO USE WATER VERSUS PUBLIC RIGHT TO USE STREAM FOR SEWAGE).
For primary bibliographic entry see Field 06E.
W71-01631

ECKART V CITY OF BELLEVILLE (CITY'S LIABILITY FOR WATER POLLUTION CAUSED BY DISCHARGE OF RAW SEWAGE INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01637

NEWKIRK V CITY OF TIPTON (SUIT FOR DAMAGES FOR REDUCTION IN LAND VALUE BECAUSE OF POLLUTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-01640

THE ALBANIA (LIABILITY FOR DISCHARGE OF OIL IN HARBOR BY SHIP).
For primary bibliographic entry see Field 06E.
W71-01643

5C. Effects of Pollution

ORGANIZATION AND DISTRIBUTION OF PHOTOPLANKTON COMMUNITIES,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
For primary bibliographic entry see Field 02L.
W71-01132

EXPERIMENTAL APPLICATION OF CHLOROPHOS FOR MOLLUSC CONTROL AT POND FARMS,
Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries (Translations).
For primary bibliographic entry see Field 05G.
W71-01140

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,
Westinghouse Ocean Research Lab., San Diego, Calif.
W. D. Clarke, J. W. Joy, and R. J. Rosenthal.
Available from NTIS as PB-195 677, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $1.00 per copy. SOD I67.13/4: 18050DAI 02/70. Water Pollution Control Research Series, 18050 DAI 02/70, February 1970. 94 p, 13 tab, 29 fig, 12 ref, 5 append. FWQA Project 18050 DAI, Contract 14-12-470.

Descriptors: *Effluents, *Aquatic environment, *Biological communities, *Environmental effects, *Desalination plants, Water pollution effects, Desalination, Florida, Ecology, Environment, Descaling, Biota, Physiological ecology, Thermal pollution, Heated water, Biological properties, Physiochemical properties, Discharge measurement, Plankton.
Identifiers: *Ecological effects, Key West (Fla), Desalting plant effluent.

The Key West study was undertaken to determine the impact of the discharge from a large desalting plant on the surrounding environment. The Phase-I work has shown that some of the properties of the effluent can be detected by physical and chemical measurements well beyond the area that visible ef-

ects can be detected in the bottom communities. While the effluent produces some beneficial effects uch as attracting certain species of fish and the tone crab, Minippe mercenaria, it has also been hown to have deleterious effects for other organ-sms. Algae, tunicates, and gastropods were ex-luded from the near-field of the effluent discharge nd bryozoan colonies were not as numerous in the ischarge area nor did they grow as well as they did utside of the area. Quantitative investigations of he physiological and ecological effects of the esalting plant effluent in future studies could lead o predictive capabilities as far as the amount of en-ironmental stress that can be tolerated at a given ocality. The Key West municipal government is onsidering locating a power plant and additional esalination facilities at the Safe Harbor site. The dditional discharges can be used to test the predic-ve models developed during the Phase-II study. or the Phase-II study, it is recommended that the ain emphasis of the study be to investigate biolog-al alterations resulting from the effluent of the esalting plant and to develop quantitative criteria or predicting and assessing the impact of a heated; ypersaline effluent on the biota of the receiving aters. Probably even more important to the hase-II study is determining the effects of descal-g operations on the environment and biota. All of he physical data for Phase-I work have been laced on magnetic tape and punched cards. It is ecommended that these data be analyzed more ompletely.
71-01266

IERCURY IN FRESHWATER FISH,
isheries Research Board of Canada, Winnipeg Manitoba).
. G. Bligh.
isheries of Canada, Vol 22, No. 10, p 7-8. May-ne, 1970.

escriptors: *Heavy metals, Public Health, Water ollution sources, Water pollution effects, *Pulp astes, Pulp and paper industry, Monitoring, Tox-ity, Industrial wastes.
dentifiers: *Mercury, Sweden, Japan, *Minamata sease, *Slimicides.

he mercury pollution problem throughout the orld is discussed. Deaths in Japan and ex-eedingly high levels of mercury in fish in Sweden e documented. The accumulation of mercury in sh muscle is rapid but elimination is slow. Thus, in sh, highest concentrations are found in larger or der fish. The author discusses the monitoring pro-am being carried out by the Fish Inspection oup of the Canadian Fisheries Research Board to etermine mercury content of marine and fresh-ater fish. If toxic levels are reached, the fish in the tch are destroyed. (Katz - Washington)
71-01267

ERCURY POLLUTION,
sheries Research Board of Canada, Winnipeg Manitoba). Freshwater Inst.
H. Hearnden.
sheries of Canada, Vol 22, No 10, p 3-6, 1970.

escriptors: *Public health, *Heavy metals, Water ollution effects, Monitoring, *Inspecting, Water ollution sources, Industrial wastes, Great Lakes.
entifiers: *Mercury, Saskatchewan River, Fishing osures.

November, 1969, a report made by the askatchewan government disclosed that abnormal vels of mercury had been detected in fish from e Saskatchewan River. The fish from the river ere immediately taken into custody and those lots ith over 0.5 ppm of mercury were destroyed. One illion pounds were incinerated. The mercury was aced to a chlor-alkali plant. With 14 of these ants operating across Canada an intensive moni-ring program was undertaken. Some additional eas were closed to fishing because of mercury ollution. Steps have been taken to control and iminate the mercury pollution problem in anada. (Katz-Washington)

W71-01268

CHLORINATED HYDROCARBONS IN THE YOUND OF LAKE MICHIGAN COHO SALMON,
Bureau of Sport Fisheries and Wildlife, LaCrosse, Wis.
Wayne A. Willford, Joe B. Sills, and Everett W. Whealdon.
The Progressive Fish-Culturist, Vol. 31, No. 4, p 220, October 1969.

Descriptors: *Chlorinated hydrocarbons, *Salmon, *DDT, Mortality, *Great Lakes, Lake Michigan, Fish eggs, Fry, Oregon.
Identifiers: *Dieldrin, *Coho.

Analysis of dead and drying sack fry from Lake Michigan revealed 3.4 ppm of DDT and related compounds plus 0.07 ppm of dieldrin, based on whole body weight. Fish that survive hatching are not exposed to contaminated water or feed excrete very little of these compounds. Theydilute them by growth. Lake Michigan eggs had 30% mortality compared with Oregon coho (4%) which contained 0.18 ppm of DDT and related compounds and no detectable dieldrin. (Wahtola-Washington)
W71-01270

KINETICS OF ONSET OF RESPONSES BY SHARKS TO WATERBORNE DRUGS,
Mote Marine Lab., Sarasota, Fla.
H. David Baldridge, Jr.
Bulletin of Marine Science, Vol. 19, No. 4, p 880-896 December 1969, 10 ref. 1 tab. 5 fig.

Descriptors: *Kinetics, *Behavioral indicators, *Sharks, *Waterborne drugs, Oxygen requirements, Temperatures, Hydrogen Ion - concentration, Mathematical studies, Repellent.
Identifiers: *Lemon sharks, *MS-222, *Quinaldine, *Strychnine Nitrate, *Sodium cyanide.

Substances tested were MS222, Quinaldine, strychnine and sodium cyanide. The occurrence along a time scale of behavioral indicators of responses elicited from young sharks by waterborne drugs was treated mathematically as a result of competitive knetic processes, in order to demonstrate applicability of classical rate theory to the study of chemical shark deterrents. First-order rates constants were calculated for the overall ability of lemon sharks to counter effects of several incapacitating drugs. Limited studies were conducted on the rate of oxygen utilization by young, free-swimming lemon sharks. (Wahtola-Washington)
W71-01271

POPULATIONS OF TROUT AND GRAYLING IN TWO SCOTTISH RIVERS,
Clyde River Purification Board, East Kilbride (Scotland).
David W. Mackay.
Journal of Fish Biology, Vol 2, p. 39-45, 1970, 4 tab, 2 fig, 9 ref.

Descriptors: *Water pollution effects, *Fish populations, Brown trout, *Growth rates, Fish management, Fish harvest, Benthic fauna, Fishkill, On-site data collections, *On-site investigations, Sport fishing, Streamflow.
Identifiers: *Grayling, Scotland, River Gryfe, Douglas Water River, Length-weight ration, Ephemeroptera, Plecoptera.

Major pollutions resulted in the deaths of all fish in 8 km long stretches of two trout streams in central Scotland. Fish were collected, measured and weighed and the ages established by scale-reading. The predominant species present were brown trout, Salmo trutta (L), and gray ping Thymallus thymallus (L) with about five times as many trout as there were grayling in each stream. The Douglas Water, which was previously unpolluted, held five times as many fish as the River Gryfe which had a history of intermittent pollution. The trout and grayling of the River Gryfe grew faster than those from the Douglas Water and there were more of the large sizes present. (Katz-Washington)
W71-01272

ACUTE TOXICITY TO FISH OF SOLUTIONS CONTAINING COMPLEX METAL CYANIDES, IN RELATION TO CONCENTRATIONS OF MOLECULAR HYDROCYANIC ACID,
Oregon State Univ., Corvallis. Fisheries Research Labs.
Peter Doudoroff, Gerard Luduc, and Carl R. Schneider.
Transactions to the American Fisheries Society, Vol 95, No 1, p 6-22, Jan. 1966. 3 tab., 1 fig, 26 ref. US Public Health Service Grant WP-162.

Descriptors: Sunfishes, *Toxicity, Bioassay, Water pollution effects, Hydrogen ion concentration, Industrial wastes, Mode of action, *Lethal limit, Carbon dioxide, Heavy metals, Gas chromatography, Analytical techniques, Evaluation.
Identifiers: *Metal cyanides, *Hydrocyanic Acid, *Cyanide ion, Nickelocyanide complex, Sodiumc cyanide, Silver cyanide.

Published indirect evidence indicating that the toxicity of solutions of complex metal cyanides to fish is a function of the concentration of molecular HCN is reviewed. The striking influence of pH on the toxicity of the nickelocyanide complex could be explained only by assuming that HCN is the toxic factor. By means of gas liquid chromatography, it was possible to demonstrate conclusively that this factor virtually along determined the acute toxicity to bluegills of various solutions of simple and complex cyanides. Median immobilization times for bluegills in the solutions varied independently of total cyanide concentrations but were clearly related to molecular HCN levels. Two of three tested solutions containing the silver-cyanide complex proved exceptional; their toxicity produced symptoms strongly suggestive of heavy-metal poisoning and was deemed referable to toxicity of the complex anions or of silver cations. The presence of representative water pollutants tested did not impair the precision and accuracy of the HCN determinations. Changes in CO2 content and pH of the medium occuring at gill surfaces had no appreciable influence on the toxicity of the nickelocyanide complex, presumably because dissociation is not very rapid. Thus, the analytical method used for determination of HCN was shown to be useful in waste disposal control. (Katz-Washington)
W71-01273

ECOLOGY OF JUVENILE TARPON AND EFFECTS OF DIELDRIN ON TWO ASSOCIATED SPECIES,
Federal Water Pollution Control Administration, Washington, D.C.
Richard Archer Wade.
Bureau of Sport Fisheries and Wildlife, Technical Paper No. 41. 1969. 85 p, 6 tab, 28 figs, 53 ref.

Descriptors: *Chlorinated hydrocarbons, *Dieldrin, *Bioassay, Toxicity, Lethal limits, Salinity, Temperature, Hydrogen Ion concentration, Distribution, Laboratory equipment, Regulated flow, Persistence, Freshwater, Estuarine environment, Laboratory equipment.
Identifiers: *Tarpon, *Sheepshead minnow, Sailfin molly, Symptoms, TLM, *Interactions, Literature review.

The chlorinated hydrocarbon compounds are ranked according to their relative toxicities to several species of fish. The distribution, persistence, and effects of dieldrin in freshwater and estuarine areas are presented. A constant-flow apparatus was constructed for bioassay testing. Methods of collection, treatment, and acclimation of Cyprinodon variegatus and Doecillia latipinna are described. Symptoms of dieldrin poisoning are described. The means and variances of 76, 48-hour TL bioassays for the effects of dieldrin at three temperatures, three salinities, and two hydrogen

ion concentrations are presented. No toxicity experiments were conducted using tarpon as a test fish. (Wahtola-Washington)
W71-01274

JUGLONE (5-HYDROXY-1,4-NAPHTHOQUINONE) AS A FISH TOXICANT,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Leif L. Marking.
Transactions of the American Fisheries Society, Vol. 99, No. 3, p 510-514, July 1970. 4 tab, 24 ref.

Descriptors: *Fish toxicant, *Biologically active, Bioassay, Toxicity, Fish, Temperature, Hydrogen ion concentration.
Identifiers: *Juglone, *Walnut trees, *LC50, Rainbow trout, Northern pike, Goldfish, Carp, White suckers, Black bullheads, Channel catfish, Green sunfish bluegills.

A new type of fish toxicant is described. Juglone, a biologically active chemical occurring in various parts of walnut trees, was tested for its toxicity to fish. The 96-hour LC50 values obtained from static bioassays at 12C range from 27 to 88 parts per billion for rainbow trout, northern pike, goldfish, carp, white suckers, black bullheads, channel catfish, green sunfish and bluegills. The toxicity of juglone to rainbow trout and bluegills was not altered significantly in waters of different temperature or hardness. Standard (pH—7.4) and buffered (pH—9.0) solutions of juglone aged for one week effectively killed rainbow trout although approximately three times as much juglone was required at the high pH. According to other investigators, juglone is easily reduced to less toxic components by factors in the natural environment. However, juglone is sufficiently persistent to eliminate target fish prior to its degradation. (Wahtola-Washington)
W71-01275

SOME ACUTE AND CHRONIC EFFECTS OF DIELDRIN ON THE SAILFIN MOLLY, POECILIA LATIPINNA,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
Charles E. Lane, and Robert J. Livingston.
Transactions of the American Fisheries Society, Vol. 99, No. 3, p. 489-495, July 1970. 2 tab, 4 fig, 20 ref.

Descriptors: *Water Pollution Effects, *Dieldrin, *Pesticides, Chlorinated hydrocarbons, Laboratory equipment, Bioassay, Toxicity, Temperature, Salinity, Tissue concentrations, *Sailfin Molly.
Identifiers: *Poecilia latipinna, Gills, Muscle, Intestine, Brain, Liver, Blood.

Acute and Chronic Effects of Dieldrin on sailfin molly were described. More than half of the experimental fishes survived 0.0015 and 0.00075 ppm of pesticide for 34 weeks. However, 0.012 ppm dieldrin killed all exposed fishes within the first week. Fishes exposed to 0.0075 ppm of pesticide contained more than 1.0 ppm in gills and blood after only one hour. After 144 hours exposure gills, blood, and brain each contained more than 6.0 ppm as determined by gas chromatography. Dieldrin concentrations in the gut, liver, and muscle after 144 hours ranged from 2.0 ppm to over 8 ppm. The mortality rate was accelerated after twenty-four hours when all sampled tissues contained between 5 and 11 ppm of dieldrin. (Wahtola-Washington)
W71-01276

BEHAVIOUR OF LOBSTERS EXPOSED TO BLEACHED KRAFT MILL EFFLUENT,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
D. W. McLeese.
Journal of the Fisheries Research Board of Canada, Vol 27, p 731-736, 1970. 1 tab, 2 fig, 7 ref.

Descriptors: *Water pollution effects, *Lobsters, Behavior, Laboratory equipment.
Identifiers: Sea water, Bleached Kraft Mill effluents, Acetic Acid, Putrid cod, Pyridine, Ammonium hydroxide, Zinc chloride.

The behavoir of lobsters exposed to bleached Kraft Mill effluent and to other chemicals was described. In laboratory tests, lobsters (Homarus americanus) did not avoid bleached draft mill effluent (BKME) at concentrations up to 20%. BKME or fresh water introduced 50 cm upstream from resting lobsters did not elicit behavioural responses. Lobsters may have detected at least two (acetic acid and Ammonium hydroxide) of six toxic or malodorous materials but did not avoid any of them. Based on these results, it seems unlikely that exposure to dilute solutions of BKME in nature would have immediate, direct effects on movement of lobsters. (Wahtola-Washington)
W71-01277

COEXISTENCE OF A FISHERY AND A MAJOR INDUSTRY IN PLACENTIA BAY,
Fisheries Research Board of Canada, Halifax (Nova Scotia).
D. R. Idler.
Chemistry in Canada, December 1969, Reprint, 6 p, 2 tab, 8 fig.

Descriptors: *Pollution control, *Industry, *Commercial fishery, Mortalities, *Bioassay, Toxicity.
Identifiers: *Herring, *Cod, *Lobsters, *Phosphorous plant fluoride, Sulfur dioxide, Ammonia, Total phosphorus, Elemental phosphorus, Cyanide.

Steps taken to limit pollution from a phosphorus plant are described. The effluent before treatment produced 100% mortality in fish exposed to it. The plant was forced to build a large lagoon and several inplant purification methods before it was allowed to pump effluent into the receiving stream. After treatment, there were no fish endangered by the effluent. (Wahtola-Washington)
W71-01279

MANHATTAN OIL CO V MOSBY (LIABILITY FOR POLLUTING STREAM BY ESCAPE OF SALT WATER FROM OIL WELL).
For primary bibliographic entry see Field 06E.
W71-01303

SYSTEMS STUDIES OF DDT TRANSPORT,
Wisconsin Univ., Madison. Dept. of Engineering; and American Trial Lawyers Association.
For primary bibliographic entry see Field 06A.
W71-01328

EFFECT OF OXYGEN CONCENTRATION ON THE RESPIRATION OF AQUATIC MACROPHYTES,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Thomas M. Bedick.
MS thesis in Sanitary Engineering, Pennsylvania State University, 1966. 54 p, 9 fig, 6 tab, 26 ref, 2 append. OWRR Project A-003-PA (3).

Descriptors: *Respiration, *Eutrophication, *Aquatic plants, *Oxygen, Phytoplankton, Benthos, Photosynthesis, Primary productivity, Biochemical oxygen demand, Temperature, Light, Phosphorus, Plant physiology, Alkalinity, Laboratory tests, Mathematical studies.
Identifiers: *Aquatic macrophytes, Anacharis canadensis, Potamogeton crispus, Reaction chambers, Oxygen meter, Regression equations.

Specimens of Anacharis canadensis and Potamogeton crispus were collected the night before analyses and acclimated for at least 12 hours to the temperature of that particular run. The plants were placed into sealed plexiglass tubes with a stirring device and allowed to respire under different conditions. The changes in oxygen concentration were recorded by a Pro Tech SM-125 meter. The relation between concentration and uptake of oxygen by both plant species was expressed by a straight line on an arithmetic plot. A rise in temperature from 10 to 20C doubled or tripled respiration rates. Respiration rates remained the same in water of a natural stream and in BOD dilution water. A prolonged pre-trial exposure of plants to either light or darkness failed to influence the dark respiration rates. (Wilde-Wisconsin)
W71-01374

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE RESPIRATION OF AQUATIC MACROPHYTES,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Dennis W. Weeter.
MS thesis in Civil Engineering, Pennsylvania State University, 1968. 57 p, 9 fig, 5 tab, 33 ref, append. OWRR Project B-016-PA (1).

Descriptors: *Environmental effects, *Respiration, *Aquatic plants, Waste water (Pollution), Agriculture, Runoff, Industrial wastes, Eutrophication, Oxygen demand, Photosynthesis, Seasonal, Sewage treatment, Velocity, Dissolved oxygen, Temperature, Mathematical studies, Biochemical oxygen demand, Vascular tissues.
Identifiers: *Macrophytes, Elodea canadensis, Potamogeton crispus.

Experimental conditions described indicate the relationship between oxygen concentration and oxygen uptake for Elodea canadensis and Potamogeton crispus can be expressed as a straight line on either an arithmetic plot or log-log plot. The following conclusions apply to continuous flow respiration system data and to regression equations established for a linear oxygen uptake versus oxygen concentration relationship. Oxygen uptake values fall well within the range of oxygen uptake values expressed by others. There was a 1-1/2 to 2 1/2-fold increase in respiration with seasonal change for Elodea canadensis at 10C and when 'polluted' stream plants were compared to 'clean' stream plants. For potamogeton crispus at 10C and 15C at the low dissolved oxygen values, the respiration of P crispus 'polluted' was approximately equal to that of P crispus 'clean,' but as dissolved oxygen increased, the slope of P crispus 'polluted' regression equation was 1-1/4 to 1-1/2 times that of P crispus 'clean.' Within the range of velocities, 0.10 to 0.40 millimeter/second, a change in velocity did not affect the respiration rate of the aquatic plants. (Jones-Wisconsin)
W71-01377

EUTROPHICATION-TROPHIC STATE RELATIONSHIPS IN NORTH AND CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 02H.
W71-01378

TICHENOR V WITHERSPOON (LIABILITY FOR DISCHARGE OF POLLUTANTS INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01416

OAKWOOD SMOKELESS COAL CORP V MEADOWS (LIABILITY FOR DAMAGE RESULTING FROM NORMAL OPERATION OF COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01432

PRIMARY PRODUCTION AS A FUNCTION OF THE STRUCTURE OF PHYTOPLANKTONIC ASSOCIATION (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 07B.
W71-01473

SOME ECOLOGICAL EFFECTS OF DISCHARGED WASTES ON MARINE LIFE,
California Univ., San Diego; and Scripps Institution of Oceanography, San Diego, Calif.
Richard W. Grigg, and Robert S. Kiwala.
California Fish and Game, Vol 56, No 3, p 145-155, 1970. 2 fig, 4 tab, 10 ref.

Descriptors: *Ecology, *Wastes, *Marine animals, *Marine plants, Depth, California, Sands, Sediments, Productivity, Toxicity, Crabs, Algae, Invertebrates, Fish, Pollutants, Turbidity, Organic loading, Coral, Mollusks, Worms.
Identifiers: San Pedro (Calif), Epibenthic species, Abalone, Tunicates, Arthropods, Coelenterates, Bryozoa, Echinoderms.

Approximately one billion gallons of sewage are discharged daily into the shallow nearshore marine environment off Southern California. A survey was made of the effect of effluent on the biology of the area in 1954. The results of a 1969 survey to collect comparable data, and to examine these to detect possible long term ecological changes are described. The numer of macroscopic species present at 5 diving stations ranging in depths from 45 to 65 feet, off the Palos Verdes Peninsula, near San Pedro, was negatively correlated to the amount of fine grain organic-laden sand present in the sediment. Organic rich sediments were thickest at stations near the outfall. Accumulation of this material at these depths appears to have modified or covered substrates otherwise suitable for the settlement of many epibenthic species. Fish, kelp, abalone and spiny lobster are particularly affected. Since bottom topography at White Point has not changed, decline of fishes, if not caused directly by toxic waste products, may indicate that relief is more important as a substrate for food rather than a source of shelter or point of orientation. (Jones-Wisconsin)
W71-01475

QUANTITATIVE SAMPLING WITH THREE BENTHIC DREDGES,
Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak. North Central Reservoir Investigations.
Patrick L. Hudson.
Transactions of the American Fisheries Society, Vol 99, No 3, p 603-607, 1970. 2 fig, 1 tab, 8 ref.

Descriptors: *Sampling, *Benthos, Silts, Sands, Technology, Depth, Volume, Lakes, Missouri River, Reservoirs, Mud.
Identifiers: *Dredges, Chironomus plumosus, Ekman dredge, Ponar dredge, Orange-peel dredge, Hexagenia, Tanypodinae, Pseudochironomus, Tanytarsus.

The sampling characteristics of the benthic dredges, 9x9-inch Ekman, the Ponar, and a Number 1 orange-peel dredge were tested in the laboratory and in the field. Sampling area and volume of bottom material collected were measured in the laboratory. Efficiency of the samplers with different bottom types and organisms were evaluated in the field. The Ekman dredge is restricted to soft and finely divided littoral bottoms of lakes, free from vegetation and intermixtures of sand and other coarse debris, which severely limits its application. Even in silty deposits it has been noted that it may not effectively sample the deeper burrowing Chironomus plumosus. However, it is useful with SCUBA because of its light weight; the sampler can be forced into the bottom and the jaws forcibly closed to assure a good grab. Bottom sampling requirements are so diverse that no one sampler has been devised to serve all purposes. Of the three samplers tested, the Ponar dredge is the most versatile and is only limited in deposits of silt over 12.7 centimeters. The orange-peel dredge, with its variable sampling characteristics and production of a shock wave, is of questionable value. (Jones-Wisconsin)
W71-01477

EUTROPHICATION CONTROL BY PLANT HARVESTING,
Florida State Board of Health, Winter Haven. Midge Research Lab.
James L. Yount, and Roy A. Crossman, Jr.
Journal Water Pollution Control Federation, Vol 42, No 5, Part 2, p R173-R183, 1970. 2 fig, 1 tab, 28 ref. FWQA Grant WP-00216.

Descriptors: *Eutrophication, *Water pollution control, Water pollution effects, *Aquatic plants, Harvesting, Ponds, Water hyacinth, Nutrients, Midges, Fish, Lakes, Conductivity, Algae, Standing crop, Chemical analysis, Mosquitoes, Bacteria, Floating plants, On-site investigations, Turtles.
Identifiers: *Chironomids, Sawdust, Eichhornia crassipes, Salvinia rotundifolia, Milorganite, Gambusia affinis, Productivity measurements, Nutrient removal.

Data reported indicate that growing organisms in hypertrophic ponds and harvesting them to remove nutrients, reduce the ponds' primary productivity. This conclusion is confirmed by experiments showing that plant productivity was reduced in test ponds, while the control ponds, where nutrients were returned, productivity remained relatively high. Large-scale harvesting from natural waters can be expected to reduce the productivity of those waters, and probably reverse the trend toward hypertrophy, especially in polluted waters. The method of controlling the 'pest' water hyacinth and other plants by chemical sprays is recirculating their nutrients to lakes and exacerbating hypertrophy. Given a constant inflow of pollutants, if too much vegetation is removed, then availability of these pollutants to other organisms would increase. The problem is resolved by managing a population on a sustained-yield basis. Harvesting hyacinths from effluent streams might prove a more practical method for handling excessive nutrients than by harvesting from lakes. (Jones-Wisconsin)
W71-01488

EFFECTS OF FOREST CUTTING AND HERBICIDE TREATMENT ON NUTRIENT BUDGETS IN THE HUBBARD BROOK WATERSHED-ECOSYSTEM,
Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences; Yale Univ., New Haven, Conn. School of Forestry; Geological Survey, Washington, D.C.; and Forest Service, (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W71-01489

EXPERIMENTAL EVIDENCE OF CHEMICAL WEED ERADICATION IN LAKE TRASIMENO (IN ITALIAN),
Perugia Univ. (Italy). Inst. of Hydrology and Fish Culture.
For primary bibliographic entry see Field 02H.
W71-01493

ENGINEERING ASPECTS OF NUTRIENT REMOVAL,
Wisconsin Univ., Madison. Water Resources Center.
Gerard A. Rohlich.
Eutrophication: Causes, consequences, correctives, p 37-382. Printing and Publishing Office, National Academy of Sciences, Washington, D.C., 1969. 3 tab, 23 ref.

Descriptors: *Nutrients, *Sanitary engineering, *Waste treatment, Phosphates, Phosphorus, Nitrogen, Biochemical oxygen demand, Aluminum, Flow rates, Hydrogen ion concentration, Industrial wastes, Municipal wastes, Suspended load, Ammonia, Wisconsin, Illinois, Texas, Sewage treatment, Costs.
Identifiers: Madison (Wis), Chicago (Ill), San Antonio (Tex).

The history of controlling nutrients in water bodies, design and construction of engineering works should be based on origins and quantities of nutrients, sources most readily subject to control, cost, and anticipated results. Ion exchange for nitrogen removal is discussed. Ammonia nitrogen may be removed by desorption in a tower packed with Rashig rings. Chemical methods have received more attention for removing phosphorus than nitrogen. Results of chemical treatment of sewages with ferric chloride are reported. Studies of an operating plant showed that mixing, flocculation, and settling are inefficient. Aluminum sulfate in the form of 'filter alum' is used as coagulant, and a process developed for its recovery. Lime, alum, and sodium hydroxide have been utilized for removal of phosphorus and nitrogen compounds. Biological methods, by which living organisms incorporate nutrients into protoplasmic structure, process flow systems, stabilization ponds, and removal of nitrogen and phosphate in the activated sludge process are evaluated. Diversion and irrigation may also reduce nutrient input to receiving waters. (See also W70-03975) (Jones-Wisconsin)
W71-01499

URBAN DRAINAGE AS A FACTOR IN EUTROPHICATION,
Public Health Service, Washington, D.C.
S. R. Weibel.
Eutrophication: Causes, consequences, correctives, p 383-403. Printing and Publishing Office, National Academy of Sciences, Washington, D.C., 1969. 2 fig, 9 tab, 32 ref.

Descriptors: *Eutrophication, *Drainage effects, Path of pollutants, Sewage, Storm runoff, Overflow, Rainfall, Sewers, Urbanization, Drainage, Interception, Costs, Waste water treatment, Storm runoff.
Identifiers: *Urban drainage, Rain water utilization.

The problems of urban drainage integrating sewage, storm-water runoff, and sewer outflows are reviewed. Attention is given to conditions anticipated at the end of the century when some 1/4 billion population is likely to be concentrated on 11% of the land. Following an account of the contributors to the urban drainage, possibilities are outlined as to the interception of rain, especially storm waters, and its use for cooling, watering gardens, recharging the ground, filling ornamental ponds, etc. Suggested preventive measures include diversion of storm-water drainage, dilution of lake water with oligotrophic water, use of ground recharge basins, partial and complete separation of sewers, storage in combined-outlet sewers and combined-outflow tunnels, treatment and monitoring combined-sewer overflows, and storm-water tanks. Some of these improvements are exemplified by constructions now in existence in the USA and Canada. (See also W70-03975) (Wilde-Wisconsin)
W71-01500

ON THE SOARING OF NON-MOTILE PLANKTONIC ALGAE,
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
For primary bibliographic entry see Field 02H.
W71-01511

ORGANIC MATERIALS IN THE MARINE ENVIRONMENTS AND THEIR INTERACTIONS WITH SOME METAL IONS,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 05B.
W71-01523

AIR AND WATER POLLUTION,
For primary bibliographic entry see Field 06E.
W71-01565

THE WATER CRISIS,
For primary bibliographic entry see Field 06E.

W71-01566

MAIER V PUBLICKER COMMERCIAL ALCOHOL CO (LIABILITY FOR POLLUTION AS PRIVATE NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01567

SEGARS V CITY OF CORNELIA (EASEMENT TO DISCHARGE SEWAGE).
For primary bibliographic entry see Field 06E.
W71-01581

G L WEBSTER CO V STEELMAN (ABATEMENT OF STREAM POLLUTION CAUSED BY CANNERY).
For primary bibliographic entry see Field 06E.
W71-01582

SEGARS V CITY OF CORNELIA (CITY'S LIABILITY FOR WASTE POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-01583

COMMONWEALTH V PHILADELPHIA AND READING IRON AND COAL CO (POLLUTION OF WATER SUPPLIES AS PUBLIC NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01599

HUBER V CITY OF BLUE EARTH (MERE PASSING OF CITY ORDINANCE NOT EFFECTIVE AS DEFENSE TO STREAM POLLUTION FROM SEWER).
For primary bibliographic entry see Field 06E.
W71-01612

DU PONT RAYON CO V RICHMOND INDUSTRIES, INC (RIPARIAN RIGHT TO USE WATER VERSUS PUBLIC RIGHT TO USE STREAM FOR SEWAGE).
For primary bibliographic entry see Field 06E.
W71-01631

ECKART V CITY OF BELLEVILLE (CITY'S LIABILITY FOR WATER POLLUTION CAUSED BY DISCHARGE OF RAW SEWAGE INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01637

NEWKIRK V CITY OF TIPTON (SUIT FOR DAMAGES FOR REDUCTION IN LAND VALUE BECAUSE OF POLLUTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-01640

5D. Waste Treatment Processes

APOLLO 12 WATER SERVICING,
National Aeronautics and Space Administration, Cocoa Beach, Fla. John F. Kennedy Space Center.
A. P. Buck, V. E. Christiansen, P. La Torre, and E. Wright.
Available from NTIS as N70-18466, $3.00 in paper copy, $0.95 in microfiche. December 19, 1969, various pagings. NASA GP-804.
Identifiers: *Apollo 12 flight, *Potable water, *Space vehicle checkout program, Life support systems, Waste water treatment, Water treatment.

The complete documentation of the water servicing for Apollo 12 is presented. The scope of water servicing includes the verification of facility demineralized water, ground support equipment water units, lunar module, command module spacecraft, portable life support system, liquid cooling garment and sterilization of water dispensers. None of the analysis reports failed the specifications during the entire chamber tests except for the sterility requirements, which were expected due to the lack of a bactericide, and there were detectable increases of the ionic species for nickel, magnesium and zinc in the command module use ports. The sterilization of the water dispenser procedure was modified by increasing the iodine bactericide solution to 80-100 parts per million.
W71-01171

DEVELOPMENT OF AN IMPROVED TUBULAR REVERSE OSMOSIS MODULE FOR WATER TREATMENT,
Philco-Ford Corp., Newport Beach, Calif.
For primary bibliographic entry see Field 03A.
W71-01199

USE OF A CONTINUOUS STREAMFLOW SIMULATOR IN WATER RESOURCES DESIGN,
Pittsburgh Univ., Pa., and Pennsylvania Dept. of Forest and Waters, Harrisburg.
For primary bibliographic entry see Field 05G.
W71-01210

BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH,
Federal Water Quality Administration, College, Alaska. Alaska Water Lab.
Sidney E. Clark, Harold J. Coutts, and Conrad D. Christianson.
Available from NTIS as PB-195 673, $3.00 in paper copy, $0.95 in microfiche. Federal Water Quality Administration Report 1610---June 1970, 36 p, 3 fig, 4 tab, 112 ref, append. FWQA-AWL Program 1610---06/70.

Descriptors: *Sewage treatment, *Biological treatment, *Sewage lagoons, *Activated sludge, *Oxidation ponds, Sewage disposal, Aerobic treatment, Stabilization ponds, Sewage disposal, Waste disposal, Waste water disposal, Waste treatment, Oxidation lagoons, Waste water treatment, *Reviews, Bibligraphies.
Identifiers: *Arctic sewage treatment, *Low temperature biological treatment, *Arctic sewage lagoons, *Low temperature activated sludge, *Cold regions extended aeration.

A literature review to establish the state-of-the-art of biological waste treatment for cold regions applications was conducted. Comments were solicited from operating agencies throughout the cold regions of the Northern Hemisphere, particularly in the United States and Canada. These agencies have provided discussion of their experiences and offered their recommendations through letters and other forms of personal communications. The review centers on the feasibility for cold regions application of lagoons (aerated, facultative, and anaerobic) and extended aeration (12 to 36 hour detention activated sludge) with emphasis placed on the effectiveness of processes at low temperatures while treating domestic sewage. Although definite design criteria are not established, many of the recommendations and conclusions provide a better basis for cold regions design of biological waste treatment facilities. The limitations of existing knowledge are expressed and recommendations for continued research are presented.
W71-01262

MICROSTRAINING AND DISINFECTION OF COMBINED SEWER OVERFLOWS,
Crane Co., King of Prussia, Pa. Cochrane Div.
George E. Glover, and Peter M. Yatsuk.
Available from NTIS AS PB-195 674, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series 11023 EVO 06/70, June 30, 1970. 75 p, 7 tab, 16 fig, 12 ref. FWQA Contract 14-12-136. FWQA Program 11023 EVO.

Descriptors: *Sewers, *Storm runoff, *Filtration, *Water pollution control, *Cost comparisons, Water Quality, Ozone, Chlorine, Biochemical oxygen demand.
Identifiers: *Microstraining, *Combined sewer overflow, *Suspended solids removal.

Microstraining (C) Copyrighted Trade Name-Crane Co., Glenfield and Kennedy Div., using a Microstrainer screen of a nominal aperture of 23 microns, removed up to 98% of the suspended solids from a combined sewer overflow. The sewer, in a residential area of Philadelphia, has an average dwf of 1,000 gph. The maximum combined sewer flow during rainstorms in one year of operation was 304,000 gph (11.3 cfs). Volatile suspended solids removals with the above screen have averaged 68% and 71% during different test periods. Results indicated that there was a slightly better kill of coliform group bacteria with chlorine than with ozone in the Microstrainer effluents when both were used at an initial nominal concentration of 5 ppm, with 5 to 12 minutes detention time. However, chlorine was applied at slightly higher levels and with better control than ozone. Preliminary estimates of the costs of treatment via Microstraining, using tentatively-established throughput rates, show that the capital costs per acre of drainage would be approximately $10,200 for Microstraining along, $11,200 for Microstraining plus chlorination, and $19,800 for Microstraining plus ozonation. Of eight other currently-proposed schemes, whose costs were estimated, only surface impoundment (where aesthetically acceptable and where low cost land is available) appears competitive.
W71-01263

COMBINED SEWER REGULATION AND MANAGEMENT.
American Public Works Association, Chicago, Ill. Research Foundation.
For primary bibliographic entry see Field 05G.
W71-01265

COEXISTENCE OF A FISHERY AND A MAJOR INDUSTRY IN PLACENTIA BAY,
Fisheries Research Board of Canada, Halifax (Nova Scotia).
For primary bibliographic entry see Field 05C.
W71-01279

ENGINEERING REPORT ON COUNTY WIDE WASTE WATER INTERCEPTING AND TREATMENT FACILITIES.
Consoer, Townsend and Associates, Chicago, Ill.

DuPage County Department of Public Works Wheaton, Illinois, July 1968. 133 p, 16 fig, 11 tab.

Descriptors: *Waste water treatment, *Waste water, *Water quality control, *Water pollution, *Urbanization, Sewerage, Sewage treatment, Sewers, Illinois, Water reuse, Construction costs, Operating costs, Cost comparisons, Financing, Municipal wastes, Planning, Illinois.
Identifiers: *Waste water treatment facilities, *Interceptor sewers, DuPage County.

A comprehensive study was made of two possible systems for meeting the waste water treatment facility needs of the fastest growing county in Illinois. One system would include a network of intercepting sewers throughout DuPage County to collect all waste waters from local sewer systems for conveyance to a large single waste water treatment plant. The other system would consist of nine separate waste water treatment plants distributed throughout the County and a network of intercepting sewer systems. The single plant system was recommended by the engineers, primarily because of the economies of scale. It would replace 8 plants presently treating about 50 mgd and serving 325,000 persons. The system, proposed for 67 mgd initially, would cost about $119 million compared to only $110 million for the multi-plant design; however, the total estimated operating cost for 15-year period (1970-1985) would be less -- $29.

illion compared to $43.6 million. The County's hare of the cost is proposed to be financed through oth revenue bonds and general obligation bonds. tate and federal aid is suggested. The proposed ystem would utilize activated sludge treatment, ertiary treatment, and, possibly, filtration and hlorination. Reuse is discussed of treated waste ater as potable water, although the proposed cilities do not contemplate this feature initially. he additional facility costs would be approximate- $38.6 million, and 1985 annual operating and aintenance costs are estimated at $2.4 million, or 0.22.6/1,000 gal. (Poertner)
/71-01337

HE ORGANIC GRADIENT IN A CONCEN-RATION COLUMN,
utgers - The State Univ., New Brunswick, N.J. /ater Resources Research Inst.
ong T. Kown.
vailable from NTIS as PB-195 777, $3.00 in aper copy, $0.95 in microfiche. New Jersey Water esources Research Institute, Rutgers University, ew Brunswick, New Jersey, Oct 1970. 47 p, 17 g, 15 ref. A-015-N.J. (1).

escriptors: *Water quality, *Water pollution, Separation techniques, *Water purification, oam fractionation, Waste water treatment.
lentifiers: *Bubble fractionation, Gas liquid inter-ce.

continuous bubble fractionation system consist-g of vertical tube provided with a source of air ubbles, means of continuous liquid feed, overflow, nd bottom effluent has been studied. The study rimarily involves an examination of the effects of ariables, such as gas rate, liquid rates, solute con-ntration and column size, on the effectiveness of e system for separating an organic solute from a lute aqueous solution. The effects of gas and quid rate on the performance have generally fol-wed the results expected from an equilibrium ad-rption of a surfactant on the gas-liquid interface escribed by Gibbs' equation and material alances. An increase in gas rate increased the ef-ctiveness of the system by providing more ad-rption surface. The adverse transfer of the solute the eddy diffusion, caused by rising bubbles was und to be the factor limiting the effectiveness of e system. Part II of the report considers effects of ariations in the height and diameter of the column pon solute concentration profile and effectiveness the column. Column heights above 30 cm were und to have little effect upon performance, and creases in column diameter greatly reduced ef-ctiveness. (Whipple-Rutgers)
/71-01340

LTERNATE METHODS OF FINANCING /ASTE TREATMENT FACILITIES,
nion Securities and Co., New York.
or primary bibliographic entry see Field 06B.
/71-01355

TILITIES: NEW TECHNIQUES, AND THEIR PPLICATION TO THE MUSKEGON COUNTY REA, A WORKING PAPER REPORT.
neafer (John R.) and Associates, Wheaton, Ill.

Muskegon County Metropolitan Planning Commis-on, Muskegon, Michigan, August 1970. 21 p, 1 g, 326 ref.

escriptors: *Municipal wastes, *Treatment facili-es, *Waste water treatment, *Water pollution ontrol, Environment, Michigan, Irrigation water.
lentifiers: *Metropolitan water resources manage-ent, Environmental problems, Environmental uality, Urban environment, Urban ecology, Muskegon County (Michigan).

he report combines previous studies which up-ated the 'Muskegon County Waste water Manage-ent Plan' of May 1969. The Muskegon plan en-iled the collection of treatment of waste water and the irrigation of waste water on land located outside the urban core. The county was able to secure the cooperation of a large industry, a paper mill using great amounts of water. A lagoon specialist assisted in the aeration lagoon design and feasibility study. Virus control through waste water irrigation was also studied and showed promise. Further research was conducted in four areas: (1) system inputs, (2) waste water transportation, (3) waste water treatment, and (4) agricultural waste water irrigation. The county's plan showed a great ability to absorb shock loads (industrial dumping) of toxic materials because of the greater volume of the biological treatment units and the system's ability to hold wastes for long periods of times. Present levels of trace elements in the waste water are not likely to interfere with its use as irrigation water. Simulation studies show that odors can be avoided. Field investigations established the feasibility of groundwater control within the irrigation site study areas. Irrigation agriculture studies concluded that perennial grasses can be harvested during the early years and crop production or beef cattle operations later. Muskegon's waste water plan shows promise for improving land for agriculture and upgrading water quality.) (Wray-Chicago)
W71-01372

INACTIVATION OF VIRUS IN NATURAL WATER AND WASTE WATER BY SILICATE MINERALS,
Maine Univ., Orono. Dept. of Civil Engineering.
Shiao Huei Lo.
MS thesis in Civil Engineering, University of Maine, 1970. 51 p. OWRR Project A-013-ME (2).

Descriptors: *Waste water treatment, *Viruses, *Silicates, Domestic wastes, Effluents, Filters, Testing.
Identifiers: *Poliomyelitis virus, Silicate filter beds, Decontamination, Actinolite, Enstatite, Kyanite, Microcline, Olivine, Sillimonite.

In the batch trials from 64,000 to 89,000 plaque forming units of polio virus were adsorbed per mg of silicate minerals ranging in size from 1 to 10 microns. The proteinaceous material in natural waters and waste waters not only competed for adsorption sites, but also desorbed the virus from the minerals. As revealed by a column study, organic matter interfered with inactivation of the virus in silicate filter beds used for treatment of domestic waste water. Removal of 99.5% of the polio virus Type I from a biologically treated effluent was achieved in a column of microcline in 7 days at a constant flow of 15 gpd/sq ft. A similar decontamination of a simulated natural water system required 12 days. (Wilde-Wisconsin)
W71-01376

MINIMAL COST ESTIMATION FOR LAKEFRONT SEWAGE SYSTEMS,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 06B.
W71-01410

BIOLOGICAL UPTAKE OF PHOSPHORUS BY ACTIVATED SLUDGE,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
Irving Yall, William H. Boughton, Richard C. Knudsen, and Norval A. Sinclair.
Applied Microbiology, Vol 20, No 1, p 145-150, 1970. 5 fig, 2 tab, 10 ref. FWQA supported.

Descriptors: *Phosphorus, *Activated sludge, Phosphorus radioisotopes, Sewage, Radioactivity, Phosphates, Chemical analysis, Algae, Microorganisms, Hydrogen ion concentration, Phenols, Arizona.
Identifiers: *Biological uptake, Calcium radioisotopes, Blooms, 2,4 dinitro phenol, Tucson (Ariz).

Experiments to reproduce conditions possibly existing in an optimally aerated, plug flow activated sludge unit are reported. Ability of activated sludge to remove phosphates was studied by adding carrier-free phosphorus-32 to raw sewage and measuring incorporation of radioactivity into cells. Radioisotope determinations indicated that 48% of phosphorus-32 radioactivity was removed in 12 hours. Chemical methods indicated that only 30% of orthophosphate apparently disappeared from the sewage during this period. Experiments with sludge relabeled with phosphorus indicated considerable phosphate turnover. Cells released large amounts of radioactivity as they were incorporating fresh phosphates. Starvation in isotonic saline for 18 hours caused sludge to dump phosphate. When introduced into fresh sewage containing phosphorus-32, the starved sludge removed about 60% of the radio-activity in 6 hours with little phosphate turnover. Ability of sludge to remove phosphorus-32 was inhibited approximately 83% by 0.001 molar 2,4-dinitro phenol. This inhibition was at the expense of the cell fraction that contained ribo-nucleic acid and deoxyribonucleic acid. The sludge cells released orthophosphate when exposed to the chemical agent. Experiments using calcium-45 indicated that calcium phosphate precipation plays a minor role in phosphate removel under experimental conditions. (Jones-Wisconsin)
W71-01474

FILTRATION TECHNIQUES IN TERTIARY TREATMENT,
Stanford Univ., Calif. Dept. of Civil Engineering.
George Tchobanoglous.
Journal Water Pollution Control Federation, Vol 42, No 4, p 604-623, 1970. 16 fig, 8 tab, 18 ref. FWQA Grant WPD21-05.

Descriptors: *Filtration, *Tertiary treatment, *Waste water treatment, Technology, Effluents, Suspended load, Solid wastes, Distribution, Dissolved solids, Conductivity, Activated sludge, Chlorine, Turbidity, Chemicals, Design.
Identifiers: Surface charge, Floc strength, Ionic strength, Anthracite, Ferric chloride, Polyelectrolytes, Mass balance analysis.

In dealing with various aspects of filtration, studies evaluating filter bed performance indicate: removal efficiency for the filtration of settled secondary effluent without the addition of chemicals is primarily a function of grain size; typical removal efficiencies using conventional single medium sand or anthracite filter beds with depths of 18-30 inches (45.7-76.2 centimeters) will vary, depending on grain size, from 10-60%. In filtration of settled effluent, with and without the addition of chemicals, turbidity break throughs were not observed within the headloss range studied--8-10 feet (2.4-3.0 meters); in present designs, the sand layer is most dual medium (anthracite and sand) filter beds is not utilized effectively; in multi-media filter beds, if the anthracite layer is greater than 16-20 inches (41-51 centimeters), media placed below the anthracite contributes little to overall suspended solids removal; polyelectrolytes can be used as an additive to achieve varying degrees of suspended solids removal from secondary effluents using single-, dual-, and multi-media filter beds. Distribution of suspended solids removed within a filter bed can be controlled by varying amount and point of addition of polyelectrolytes. (Jones-Wisconsin)
W71-01479

ADVANCED WASTEWATER TREATMENT,
Smith and Loveless, Lenaxa, Kans. Research and Development Dept.
Brian L. Goodman, and Kenneth A. Mikkelson.
Chemical Engineering, Vol 77, No 9, p 75-83, 1970. 11 fig, 1 tab, 33 ref.

Descriptors: *Waste water treatment, *Phosphorus, *Suspended load, *Solid wastes, Biochemical oxygen demand, Chemical precipitation, Effluents, Filtration, Separation techniques,

Hydrogen ion concentration, Operating costs, Monitoring, Mathematical models, Iron, Aluminum, Sludge, Economics, Filters.
Identifiers: Polyelectrolytes, Biological-chemical process, Polymers, Dual-media filter, Suspended solids.

The combined biological-chemical process offers inherent simplicity, low capital cost and ease of integration into conventional activated sludge plants. For efficiency the combined process requires low sludge age, proper point of chemical addition and effective solid-liquid separation in final clarification step. Basically, soluble phosphorus is converted to insoluble form by complexing with metallic ions coupled with microbial phosphorus assimilation, and incorporation of insoluble phosphorus into sludge mass and its removal from the liquid phase by efficient solids-liquid separation device. Synthetic organic polyelectrolytes are utilized for particle agglomeration and removal; modification of conventional clarifier design to use the clarifier floc blanket as a filtering device improves clarification. Incorporation of automatically-actuated backwash cycles, quality monitoring, proper flow distribution, efficient 'cleansing' of the media between cycles, proper design of systems, duration of filtration cycles are important. Due to relatively low dosage needed to achieve substantial increase in settling rate, water soluble, cationic polymers are best suited, generally. After an initial polymer treatment, the dosage was reduced to 1/5. Effluent solids concentration then fell to an acceptable level, maintained until polymer addition was terminated. Following polymer treatment, the beneficial effect decayed with time. (Jones-Wisconsin)
W71-01480

EVALUATION OF THE POLLUTION LOAD OF RESIDUAL WATERS FROM WINE DISTILLERIES (IN FRENCH),
Institut National de la Recherce Agronomique, Narbonne (France). Station Centrale de Technologie des Produits Vegetaux.
J. Mourgues, and J. Maugenet.
English summary. Annales de Technologie Agricole, Vol 18, No 2, p 129-137, 1969. 2 fig, 3 tab.

Descriptors: *Waste water treatment, *Industrial wastes, Water pollution sources, Effluents, Biochemical oxygen demand, Chemical oxygen demand, Phenols, Biodegradation, Analysis.
Identifiers: *Wine distillation effluents, Polyphenols, Tannins, 5-day biochemical oxygen demand.

Analyses of effluents from several wine distilleries yielded an approximate average chemical oxygen demand of 0.24% and a 5-day biochemical oxygen demand of 0.14%. Ethanol, glycerol, lactic acid, acetic acid, and polyphenols exhibited high COD exceeding 1 gram of oxygen/gram of the substance; the COD of tartaric acid was about 0.5. All ingredients of the effluent, except polyphenols, are readily biodegradable. It is advisable to eliminate polyphenols by either chemical precipitation or decomposition by an appropriate microflora prior to the discharge of the residual liquor. The degree of pollution by the effluent is indirectly related to the quality of distilled wine, the inferior piquette grade providing the maximum load of pollutants. (Wilde-Wisconsin)
W71-01486

ENGINEERING ASPECTS OF NUTRIENT REMOVAL,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05C.
W71-01499

5E. Ultimate Disposal of Wastes

DEVELOPMENT OF A PROTOTYPE WASTE COLLECTION SYSTEM (THE HYDRO-JOHN),
General Electric Co., Philadelphia, Pa. Space Div.
For primary bibliographic entry see Field 05G.
W71-01124

FURTHER CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
Woods Hole Oceanographic Institution Technical Report, Reference No 70-42, September 1970. 24 p, 5 fig, 2 tab, 6 ref. 3 append. (Unpublished manuscript).

Descriptors: *Sewage disposal, *Infiltration, *Water spreading, *Monitoring, Water pollution sources, Sewage treatment, Waste water disposal, Nitrates, Eutrophication, Aquifers, Groundwater movement, Massachusetts.
Identifiers: Infiltration ponds, Cape Cod (Mass), Falmouth (Mass).

If the town of Falmouth, Mass., decides to dispose of secondary-treated sewage effluent at an inland site, the groundwaters downstream of the disposal site should be monitored carefully, and adequate space and access for more advanced waste-treatment facilities should be included in the plant in case the monitoring shows that deleterious substances are beginning to contaminate the groundwater. The present inland sewage disposal plant at Otis Air Force Base has no significant effect on groundwater quality at its present low level of operations. Effluent from a proposed inland site could contaminate nearly groundwater and contribute to the overfertilization of estuaries in southern Falmouth. Disposal of 3.7 mgd of effluent through a sea outfall could result in a general decline in groundwater levels of 3 to 5 inches; therefore, careful disposal by recharge is recommended to conserve groundwater. (Knapp-USGS)
W71-01205

CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS,
Woods Hole Oceanographic Institution, Mass.
Robert H. Meade, and Ralph F. Vaccaro.
Technical Report, Reference No 70-3, February 1970. 22 p, 4 fig, 1 tab, 9 ref, 2 append. (Unpublished manuscript).

Descriptors: *Infiltration, *Water spreading, *Monitoring, Water pollution sources, Sewage treatment, Waste water disposal, Nitrates, Eutrophication, Aquifers, Groundwater movement, Massachusetts.
Identifiers: Infiltration ponds, Cape Cod (Mass), Falmouth (Mass).

The consequences are considered of disposing of secondary treated effluent from the town of Falmouth, Mass., by infiltration inland sites rather than by marine outfalls. For the terminal disposal of treated sewage effluents, transfer into the ground can be an acceptable and effective method. Very many sewage treatment plants operate in this manner. In many instances, such practice enhances water conservation by helping maintain groundwater reserves. However, in towns such as Falmouth, which depend upon groundwater for potable water, great care must be taken to assure that recharging does not cause any undue contamination of the local groundwater system. Nitrate is one of the more unpredictable by-products of sewage treatment and its ultimate appearance in natural waters can have an adverse effect on water quality. Excessive amounts of nitrate, in conjunction with other plant nutrients, can lead to unsightly blooms of nuisance aquatic plants once exposure to sunlight is provided. Adequate allowance for this uncertainty should be provided at the planning stages of any inland sewage disposal plant which depends upon terminal disposal into the ground. An early warning monitoring system of observation wells near the disposal site is recommended to detect any incipient contamination problem before it becomes serious. (Knapp-USGS)
W71-01324

HAMPTON V TOWN OF SPINDALE (DISCHARGE OF INDUSTRIAL WASTES INTO MUNICIPAL SEWER SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01437

LAND BURIAL OF SOLID RADIOACTIVE WASTES: STUDY OF COMMERCIAL OPERATIONS AND FACILITIES,
Division of Reactor Development and Technology (AEC), Washington, D.C. Environmental and Sanitary Engineering Branch.
Roy J. Morton.
Available from NTIS as WASH-1143, $3.00 in paper copy, $0.95 in microfiche. 1968. 133 p.
Identifiers: *Radioactive waste, Disposal, Safety, Geology, Hydrology, *Solid waste disposal.

This study reviews current practice in the disposal of solid radioactive wastes by land burial. The primary purpose was to assemble information and develop conclusions regarding commercial waste burial operations on government-owned sites and to submit recommendations for such operations in the future. The disposal of radioactive mill tailings was excluded; shallow ground disposal of the more highly radioactive solid wastes was also precluded. The facilities and procedures at five waste burial sites, during the time period 1962-1966, were considered. This report also emphasizes the factors affecting the health and safety of the public which are of primary importance in the appraisal of ground disposal sites and evaluation of radioactive waste handling and land burial procedures.
W71-01501

WASTE MANAGEMENT CONCEPTS FOR THE COASTAL ZONE, REQUIREMENTS FOR RESEARCH AND INVESTIGATION.
National Academy of Sciences-National Research Council, Washington, D.C. Committee on Oceanography.
For primary bibliographic entry see Field 05G.
W71-01544

5F. Water Treatment and Quality Alteration

NON-CHOLERA VIBRIOS OF EGYPTIAN SURFACE WATERS,
Naval Medical Research Unit No. 3, Cairo (Egypt).
W. R. Sanborn, A. W. Wahba, P. E. Ewald, and Abdalla S. Diab.
Available from NTIS as AD-704 247, $3.00 in paper copy, $0.95 in microfiche. Published in Journal of the Egyptian Public Health Association, Vol 43, No 4, p 320-328, 1968.
Identifiers: *Vibrio, Identification, Egypt, Water, Agglutinins, Detection, Bacteria, Cholera.

A schema for the isolation and identification of vibrios from water samples is described. All the Heiberg biochemical groups of vibrios may be found in Egyptian surface waters. Group I and II were the most common strains found in Nile water. No agglutinable vibrios were discovered. Non-agglutinable vibrios can exist in an environment where cholera is absent. These were isolated in two successive years.
W71-01161

APOLLO 12 WATER SERVICING,
National Aeronautics and Space Administration, Cocoa Beach, Fla. John F. Kennedy Space Center.
For primary bibliographic entry see Field 05D.
W71-01171

BIOLOGICAL AND CHEMICAL ASPECTS OF RHINE WATER IN THE BERENPLAAT RESERVOIR,
Drinkwaterleiding der Gemeente Rotterdam (Netherlands).
John J. Rook, and Gijsbert Oskam.
Journal American Water Works Association, Vol 62, No 4, p 249-259, 1970. 10 fig, 7 tab, 30 ref.

Descriptors: *Water purification, *Detention reservoirs, Reservoirs, Photosynthesis, Dissolved oxygen, Phosphates, Water yield improvement, Water pollution treatment, Algae, Potable water, Taste, Ammonia, Silica.
Identifiers: Rhine River, Asterionella formosa, Cryptomonas, Chlamidomonas, Berenplaat Reservoir (Rotterdam), The Netherlands.

A considerable purification of the highly polluted water of the Rhine River is achieved by its relatively brief storage in a retention reservoir. The high level of river's fertility induces a heavy growth of algae, particularly Asterionella formosa. The storage and re-aeration of the algal suspension promotes photosynthesis and restores the content of dissolved oxygen. An occasional increase in dissolved organic matter in the reservoir has failed to produce unfavorable effects on potassium permanganate consumption. The growing algae utilize large amounts of phosphates and silica; the latter appears to act as a limiting factor. The ammonia content is reduced by loss to the atmosphere and by nitrification, the nitrates presumably contributing to the dissimilation of settled organic matter. The most important benefit of the xtorage of Rhine water is the striking reduction in threshold taste value. The algae are withdrawn from the reservoir prior to their completion of the life cycle. An opinion is expressed that the Netherlands will build many new Rhine reservoirs. (Wilde-Wisconsin)
W71-01491

5G. Water Quality Control

GEOLOGY FOR PLANNING AT CRESCENT CITY, ILLINOIS.
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 03D.
W71-01111

SCIENCE AND TECHNOLOGY AND ITS APPLICATION TO THE PROBLEMS OF POLLUTION, TRANSPORTATION AND EMPLOYMENT. PUBLIC SCIENCE POLICY: BACKGROUND READINGS,
Federation of Rocky Mountain States, Inc., Denver, Colo.
For primary bibliographic entry see Field 06G.
W71-01118

DEVELOPMENT OF A PROTOTYPE WASTE COLLECTION SYSTEM (THE HYDRO-JOHN),
General Electric Co., Philadelphia, Pa. Space Div.
L. W. Murray, and J. J. Reville.
Available from NTIS as N70-28007, $3.00 in paper copy, $0.95 in microfiche. February 1970. 73 p. NAS 9-9741.
Identifiers: *Human wastes, *Sanitation, *Waste disposal, Cleanliness, Environmental control, Equipment specifications, Hygiene, Systems engineering.

The prototype waste collection system described demonstrates spacecraft type sanitary urine and feces collection techniques for male personnel. The system features a manually initiated, automatically controlled anal wash and dry cycle after defecation as well as a feces/wash water blending and discharge cycle. It also features an adjustable urinal which is designed to collect urine while preventing spillage during micturition. Both the feces and urine collection techniques are designed for us in either a zero or one gravity environment. Overall reactions to the system by eight users were favorable and are defined.
W71-01124

EVALUATION OF THE HAZARD OF BULK WATER TRANSPORTATION OF INDUSTRIAL CHEMICALS: A TENTATIVE GUIDE.
National Academy of Sciences-National Research Council, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-01135

RADIOACTIVITY IN WATER: PROJECT RULISON,
Teledyne Isotopes, Palo Alto, Calif.
William E. Nork, and Paul R. Fenske.
Available from NTIS as NVO-1229-131, $3.00 in paper copy, $0.95 in microfiche. February 1970. 14 p. AT(29-2)-1229.
Identifiers: *Petroleum industry, *Nuclear explosions, *Hydrology, *Radioactive isotopes, Underground explosions, Rulison operation, *Natural gas.

The Project RULISON detonation was wholly contained, as planned, within the rocks of the Mesaverde Group. Explosion-produced radioactivity was initially distributed non-uniformly in the collapsed chimney and fractured rock surrounding the working point, WP. Redistribution of the explosion-radioactivity will occur as a result of transport of dissolved and/or particulate matter in any existing mobile groundwater in Mesaverde Formation rocks or as a consequence of re-entry drilling and testing. Quite possibly, groundwater in the Mesaverde Formation is immobile. In this case all radioactivity will reside where it was initially emplaced unless it is artificially removed, and will decay eventually to concentrations below 'Concentration Guides' levels. Any mobile water in the Mesaverde Formation which becomes contaminated with explosion nuclides, and is located below about 7000 feet is expected to move downward or laterally but not upward. Above 7000 feet any contaminated mobile waters are expected to move laterally. Hydrologic data indicate that the rate of movement of contaminated water will be essentially negligible. Very likely the rate of movement will be low enough and chemical-exchange retardation high enough to prevent transport of nuclides in greater-than-CG concentrations for any significant distances.
W71-01136

EXPERIMENTAL APPLICATION OF CHLOROPHOS FOR MOLLUSC CONTROL AT POND FARMS,
Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries (Translations).
V. A. Musselivs, and V. I. Laptev.
Available from NTIS as PB-192 866T, $3.00 in paper copy, $0.95 in microfiche. Russian translations, March 1970. 6 p.
Identifiers: *Fishes, Industries, *Molluscides, Organic phosphorous compounds, Pest control, Insecticides, Tests, Dosage, USSR, Fisheries, *Trichlorfon, Phosphoric/acid/ (dimethyl-ester)- (1-hydroxy-2-2-trichloro)ethyl.

Tests with chlorophos (trichlorfon) were studied regarding its effectiveness in the control of gastropod molluscs; its residual effect on fish has not been studied at all. The experiments were conducted to clarify the optimal does of the preparation as a molluscicide and its influence in test concentrations on fish, and to investigate methods of applying it.
W71-01140

CONTAINMENT OF OIL SPILLS BY PHYSICAL AND AIR BARRIERS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
David P. Hoult.
Available from NTIS as PB-192 629, $3.00 in paper copy, $0.95 in microfiche. 1970. 18 p, figs. FWPCA Project 15080-ESL.
Identifiers: *Water pollution, *Oils, *Booms, Water pollution, Theory, Mathematical analysis, *Oil pollution, Oil spills, *Water pollution control equipment, Stoppollution project.

A review of the state of the understanding of barriers to contain oil is presented. Using recent results, the main design parameters for a physical barrier in a steady current are presented. Included are discussions of draw down, forces, moments, and the configuration a boom takes on when deployed in a current. In each topic, comparison is made with experimental results and available theory. It is shown that a properly designed boom may hold large amounts of oil against a steady current. A brief discussion of the implications of these new results for air barriers is presented also.
W71-01141

PITTARD V SUMMEROUR (ENJOINING OF ALLEGED NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01148

COMPREHENSIVE REPORT FOR THE ALASKA STATE HOUSING AUTHORITY, WATER AND SEWAGE SYSTEMS IN THE GREATER JUNEAU BOROUGH, ALASKA.
Alaska State Housing Authority, Anchorage.
For primary bibliographic entry see Field 06B.
W71-01156

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics Inc., Laurel, Md.
W. T. Lindenmuth, J. O. Scherer, and P. Van Dyke.
Available from NTIS as AD-702 513, $3.00 in paper copy, $0.95 in microfiche. Technical Report 948-1 (11), January 1970, various pagings. DOT Contract DOT-CG-93907-A.
Identifiers: *Water pollution, Control systems, *Petroleum, Water pollution, *Floating bodies, Performance (Engineering), Motion, Mathematical analysis, Model tests, Programming (Computers), Resonant frequency, Mechanical properties, Water waves, Design, Cylindrical bodies, Force (Mechanics), *Oil retention booms, *Oil spills.

The document presents a theoretical analysis of the loads and motions of a continuous, elastic, oil retention boom of arbitrary configuration. The boom is subjected to loads of wind, current, and an irregular sea. The analytical method was programmed for an IBM 1130 computer and used to generate data for a variety of oil booms. Towing tank tests were conducted on selected boom configurations and serve to check the theoretical analysis.
W71-01172

COMPREHENSIVE WATER AND SEWER PLAN FOR BALDWIN COUNTY, ALABAMA.
South Alabama Regional Planning Commission, Mobile.
For primary bibliographic entry see Field 06B.
W71-01174

PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970.
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 09A.
W71-01192

USE OF A CONTINUOUS STREAMFLOW SIMULATOR IN WATER RESOURCES DESIGN,
Pittsburgh Univ., Pa., and Pennsylvania Dept. of Forest and Waters, Harrisburg.
Rafael G. Quimpo, and Jan C. Phillips.
French resume included. In: Proceedings 13th Congress of the Internation Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 83-90, 1969. 8 p, 1 fig, 6 ref. OWRR Grant No 14-01-0001-1590.

Descriptors: *Simulation analysis, *Stochastic processes, *Waste assimilative capacity, *Streamflow forecasting, Analog models, Mathematical models, Statistical models, Design, Sewage treatment, Waste water disposal, Planning, Probability, Water resources development.
Identifiers: Water resources design.

To study efficient utilization of the dilution capability of a river and still maintain the quality of surface water resources, stochastic modeling of streamflow in design was investigated. The time variability of river discharges is expressed statistically and incorporated in an analog model to simulate the future variations of flows in the stream. The streamflow simulator is used to obtain a design configuration for a waste treatment plant. The dilution capacities of the simulated flows and assumed water quality standards determine the rate of waste release, thus imposing external constraints on the plant design. Using cost data for different waste treatment levels, the simulator is operated in conjunction with different combinations of treatment plant components to determine which combination results in the most efficient operation during a 70-day period of critical streamflow. (Knapp-USGS)
W71-01210

BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH,
Federal Water Quality Administration, College, Alaska. Alaska Water Lab.
For primary bibliographic entry see Field 05D.
W71-01262

MICROSTRAINING AND DISINFECTION OF COMBINED SEWER OVERFLOWS,
Crane Co., King of Prussia, Pa. Cochrane Div.
For primary bibliographic entry see Field 05D.
W71-01263

COMBINED SEWER REGULATION AND MANAGEMENT.
American Public Works Association, Chicago, Ill. Research Foundation.

Available from NTIS as PB-195 676, $0.95 in microfiche. Also for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. SOD I67.13/4: 11022D-MO 08/70. Water Control Research Series 11022 DMU 08/70, July 1970, 134 p, 2 tab, 41 fig. FWQA Contract 14-12-456. FWQA Program 11022 DMU 08/70.

Descriptors: *Overflow, Regulation, Design, Operations, Maintenance, *Sewers, Water pollution control, Watste water treatment.
Identifiers: *Combined sewers, system control, quantity of overflow, quanity of overflow, Tide gates, *Overflow regulation.

Design application, operation and maintenance of combined sewer overflow regulator facilities are detailed in this Manual of Practice, developed in conjunction with a report prepared on combined sewer overflow regulators. Design calculations are given for various types of regulators and tide gates. A sample regulator facility control program is given to illustrate the development of a control system. Operation and maintenance guidelines are also given. Thirty-eight sketches and photographs are included. (Sullivan-APWA Research Foundation)
W71-01265

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
For primary bibliographic entry see Field 06B.
W71-01300

RESEARCH NEEDS IN THE CIVIL ENGINEERING ASPECTS OF POWER.
For primary bibliographic entry see Field 08C.
W71-01318

PENNSYLVANIA ERASES ITS MINING SCARS,
Ackenheil (A.C.) and Associates, Inc., Pittsburgh, Pa.
Alfred C. Ackenheil.
Civil Engineering, Vol 40, No 10, p 54-56, October 1970. 3 p, 1 fig, 3 photo.

Descriptors: *Mine drainage, *Mining, *Environmental effects, *Pollution abatement, *Pennsylvania, Land reclamation, Watershed management, Mine water, Land subsidence, Underground structures, Water pollution sources, Strip mines.
Identifiers: Chartiers Creek Watershed, Environmental damages, Restoration program, Operation Scarlift.

A $200-million program to wipe out environmental damages left by a century of coal mining, particularly mine drainage pollution is underway in the Chartiers Creek Watershed. Known as Operation Scarlift, its main goals are: (1) to eliminate pollution from mine waters of 3,000 mi of Pennsylvania's 50,000 miles of streams and rivers; (2) to put out fires at abandoned mines; (3) to prevent surface cave-ins; and (4) to restore the 200,000 acres of abandoned surface mines to their original contour. The article focuses on the Chartiers Watershed, an important area near Pittsburgh, where drainage from abandoned surface and underground mines causes many problems. Details are given as to how the major sources of mine drainage were located and what is being done to plug up these sources permanently. (Lang-USGS)
W71-01330

SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM.
Kaiser Engineers, Oakland, Calif.

Project supported in part by the Federal Water Pollution Control Administration.Final Report to California State Water Resources Control Board, Sacramento, June 1969. 545 p, 76 fig, 110 tab, 69 ref.

Descriptors: *Bays, *Deltas, *Estuaries, *Water quality control, *Water pollution control, *Waste water, *Drainage effects, Programs, *Planning, *Reclamation, *Oceans, California, Coliforms, Pesticides, Pesticide toxicity, Toxicity, Oceanography, Agricultural watersheds, Eutrophication, Urbanization, California.
Identifiers: *Waste water management, *San Francisco Bay, Ocean disposal, Sacramento River, San Joaquin River.

The San Francisco Bay-Delta Water Quality Control Program was authorized in 1965 when the California State Legislature passed the Water Pollution Control Law. The State Water Quality Board contracted with Kaiser Engineers to conduct a comprehensive study of the effects of waste water and drainage discharges into the Bay and Delta, and to develop the basic features of a comprehensive plan for the control of water pollution. After evaluating various management alternatives, the engineers recommended that a regional waste water management agency be formed promptly to plan, design, construct and operate a water pollution and quality control system throughout the twelve counties comprizing the Bay-Delta area. The physical facilities recommended would encompass two key features: (1) transporting non-reclaimable waste materials to the sea, initially by discharge to that portion of the Bay where waters are rapidly exchanged with ocean waters, and later by actual conveyance to the ocean; and (2) maximum reclamation and reuse of waste waters as supplemental water supplies. The first phase of construction is recommended for completion 1980 and is estimated to cost $750 million, in 1969 dollars. The major water quality problems were found to be related to eutrophication, toxic effects of waste water discharges, persistent pesticides, and excessive concentrations of coliform bacteria. (Poertner)
W71-01333

INSTREAM AERATORS FOR POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Francis P. Coughlan, and Shaw L. Yu.
Journal of Sanitary Engineering division, ASCE, Vol. 96, No. S5S, Proc. Paper 7631, Oct. 1970, p 1153-1165, 7 fig, 2 tab, 9 ref.

Descriptors: *Temperature, *Aeration, Oxygen demand, Systems analysis, Waste water treatment, Dissolved oxygen, Costs.
Identifiers: Deoxygenation coefficient, Transfer rate, Flow velocity, Polluted river, Aerators.

Field tests and performance analysis of instream aeration equipment on the Passaic River showed mechanical aerators were more efficient than diffusers. Transfer rates varied maredly with oxygen deficit, temperature, and velocity of flow. Unexpectedly, the rate of deoxygenation increased greatly downstream of the aerators. Cost estimates indicate that nine 75-hp mechanical aerators with total rated capacity of 675 hp would have total annual costs of $102,000 or $151 per annual hp of rated capacity. Electric-drive diffuser aerators rated at 80 hp each would have total annual cost of $141,400 or $147 per annual hp of rated capacity. No injured fish were observed in two seasons of operation. A systems analysis, based upon the principle of BOD mass balance analysis, showed that aerators would achieve a given dissolved oxygen level at about one-fourth the cost of advanced waste treatment. Application should be considered for those streams where secondary waste treatment is not sufficient to achieved dissolved oxygen levels desired. (Upadhyaya-Vanderbilt)
W71-01342

ECONOMICS OF WATER QUALITY: AN APPLICATION TO THE DES MOINES RIVER BASIN.
Iowa Univ., Iowa City. Dept. of Economics.
For primary bibliographic entry see Field 06B.
W71-01353

THE COST OF IMPROVING WATER QUALITY IN THE GREAT LAKES,
State Univ. of New York, Syracuse. Water Resource Center.
For primary bibliographic entry see Field 06C.
W71-01354

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06B.
W71-01358

QUALITY OF STORMWATER DRAINAGE FROM URBAN LAND AREAS IN NORTH CAROLINA.
North Carolina Water Resources Research Inst. Raleigh.
Edward H. Bryan.
Available from NTIS as PB 195 781, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute Report No. 37, June 1970. 43 p. OWRR Project A-034-NC (2).

Descriptors: Storm runoff, Surface runoff, Water quality control, *North Carolina, Water quality, Drainage, Urbanization, *Suface drainage.
Identifiers: Urban land runoff, *Durham (North Carolina), *Storm water.

The objective of this project was to determine the quality characteristics of stormwater draining from an urban land drainage basin in North Carolina as influenced by the nature of land use on the basin. A number of areas in North Carolina and elsewhere are confronted with the need to require high degrees of water quality management. Urbanization of a region has an effect on the quality of its stormwater. The purpose of this study was to determine quantitative relationships between different land-use patterns and consequent differences in the water quality. The drainage basin selected has an area of 1.67 square miles and is in the upper portion of the Cape River Basin of North Carolina. Residential, commercial and industrial activities on the selected basin are representative of the urban land-use pattern in North Carolina cities and towns. During the first year a gaging and sampling station was installed on the outlet of the major basin. Sampling and analyses were initiated to characterize the quality of water draining from the basin and its two major constituent basins. In the second year, the major basin was divided into a number of subsidiary basins to characterize the quality of water draining from each sub-basin and attempt correlation of its qualities with land use. Urban stormwater was found to be a significant source of pollutional constituents to receiving streams. With respect to BOD, the total weight contribution by stormwater from this basin was estimated to equal that of its sanitary wastewater effluent from secondary treatment. The contribution of total organic matter as measured by chemical oxygen demand in its stormwater was greater than that attributable to discharge of raw sanitary wastewater from a strictly residential, average urban area. The total solids contribution by urban stormwater was substantially larger than would be expected from average raw domestic wastewater. The contribution of phosphate from this urban basin was nominal for urban stormwater in comparison with that of domestic wastewater. (Howells-North Carolina)
W71-01360

ESTORATION OF LOST AND DEGRADED ABITATS,
mithsonian Institution, Washington, D.C.
or primary bibliographic entry see Field 06G.
71-01367

TILITIES: NEW TECHNIQUES, AND THEIR PPLICATION TO THE MUSKEGON COUNTY REA, A WORKING PAPER REPORT.
heafer (John R.) and Associates, Wheaton, Ill.
or primary bibliographic entry see Field 05D.
71-01372

OUNDSVILLE WATER CO V MOUNDSVILLE AND CO (TRESPASSER'S LIABILITY FOR AMAGE TO WATER SUPPLY LINE).
or primary bibliographic entry see Field 06E.
71-01431

HE SS NEA HELLIS (FINES FOR DISCHARGG OIL INTO NAVIGABLE WATERS).
or primary bibliographic entry see Field 06E.
71-01450

NITED STATES V THE DELVALLE (UNINENTIONAL WATER POLLUTION BY NUSED FUEL OIL).
or primary bibliographic entry see Field 06E.
71-01454

NALYSIS AND MODEL TESTS TO DETERINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
ydronautics, Inc., Laurel, Md.
or primary bibliographic entry see Field 08B.
71-01527

CONTAINMENT AND COLLECTION DEVICES FOR OIL SLICKS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
David P. Hoult.
Available from NTIS as PB-190 377, $3.00 in paper copy, $0.95 in microfiche. Publication No 69-8, August 1969. 15 p, 7 fig, 5 ref.
Identifiers: *Oil slicks, *Oil pollution, Oil spills, *Oils, *Films, *Collecting methods, *Water pollution, *Booms, Pneumatic devices, Oceans, Containment, Performance (Engineering), Baffles, Compressed air, Buoyancy.

The main engineering features of physical and pneumatic booms operating as oil containment devices in the open sea are discussed. The oil containing capacity of a pneumatic boom is limited by the power available to compress the air. It is suggested that the containment capacity of physical booms is limited by the effective depth of the boom. The results of preliminary experiments are used to establish these ideas. A brief review of the main types of collection systems in use is given.
W71-01528

WASTE MANAGEMENT CONCEPTS FOR THE COASTAL ZONE, REQUIREMENTS FOR RESEARCH AND INVESTIGATION.
National Academy of Sciences-National Research Council, Washington, D.C. Committee on Oceanography.

Available from Printing and Publishing Office National Academy of Sciences, 2101 Constitution Ave. NW, Wash, DC 20418, PC $3.50. Microfiche available from NTIS as PB-195 861, $0.95. National Academy of Sciences - National Academy of Engineering, Washington, DC, 1970. 126 p, 15 tab, 2 fig, 286 ref, 4 append. FWQA Program 16070 DUF.

Descriptors: *Waste disposal, *Coasts monitoring, Hydrodynamics, Chemical reactions, Ecology.
Identifiers: *Waste management, *Coastal zone, *Research priorities, Physical process, Biological effects, Ecological impacts.

The scientific and engineering requirements were evaluated for research related to coastal wastes management based upon 16 background papers in 4 fields: monitoring, physical effects, chemical effects, chemical and biological effects. The focus is on recommended research subjects in each of these fields, ranked as to priority, and accompanied with estimates of minimum effort required including completion time. Research required to implement the monitoring plan includes: uniform sampling procedures and quantitation of: (1) floatable matter, (2) films, (3) persistent pesticides, (4) persistent organics, (5) heavy metals, (6) acute toxicity, (7) biostimulants, (8) biomass, and (9) community-structure productivity. Research problems in physical process comprise: interactions including dilution and diffuser design, physical processes in estuaries and coastal areas, turbulent flux, decay of nonconservative substances, interactions between floatable and settleable components of wastes. Recommended areas of research in chemical factors include: trace metals, complexing, inorganic and organic aggregation, diagenesis, nutrient fluxes, organic matter distribution, phytoplankton blooms, anoxic conditions, biochemical concentrations, sublethal effects, oil spillage, synthetic organics, and human physical activities. Recommended research on biological effects include: effects of outfall areas, health significance of wastes, biological concentration, DDT, biological communities, tolerance limits for major uses, improvement of systems and models, criteria for review of proposals for ecological study requirements, and evaluation of new waste products.
W71-01544

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,
For primary bibliographic entry see Field 06E.
W71-01547

WATER LAW IN SOUTHEASTERN WISCONSIN.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01551

WATERS-POLLUTION-DISCHARGE LICENSE.
For primary bibliographic entry see Field 06E.
W71-01555

OIL DISCHARGE PREVENTION AND POLLUTION CONTROL.
For primary bibliographic entry see Field 06E.
W71-01556

AN ACT RELATING TO WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 06E.
W71-01558

LET THE POLLUTER BEWARE (LEGAL RAMIFICATIONS OF POLLUTION),
For primary bibliographic entry see Field 06E.
W71-01562

REGULATION OF POLLUTION BY MINE WASTES.
For primary bibliographic entry see Field 06E.
W71-01570

I. COMPREHENSIVE PLAN FOR THE FOX RIVER WATERSHED, CH 14 (SURVEY OF LEGAL ASPECTS OF WATERSHED DEVELOPMENT).
For primary bibliographic entry see Field 06E.
W71-01578

UNITED STATES V CARROLL OIL TERMINALS, INC (ACCIDENTAL OIL LEAKAGE CAUSED BY STORM DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01595

PUBLIC SERV COMM'N V SINKING SPRING WATER CO (REQUIRING POTABLE WATER FROM SUPPLIER).
For primary bibliographic entry see Field 06E.
W71-01602

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

USE OF STOCHASTIC HYDROLOGY TO DETERMINE STORAGE REQUIREMENTS FOR RESERVOIRS -- A CRITICAL ANALYSIS,
Stanford Univ., Calif. Program in Engineering Economic Planning.
Stephen J. Burges.
Available from NTIS as PB-195 691, $3.00 in paper copy, $0.95 in microfiche. Project on Engineering-Economic Planning, Report EEP-34, September 1970. 208 p, 27 tab, 56 fig, 68 ref. OWWR Project C-1635 (No 3150) (1).

Descriptors: *Synthetic hydrology, *Monte Carlo method, *Draft-storage curves, *Reliability, *Correlation analysis, Analytical techniques, Hydrologic data, Markov processes, Mass curves, Mathematical models, Regression analysis, Sequential generation, Statistical methods, Variability, Stochastic processes.

A study was conducted to locate areas of uncertainty when Markov runoff generation models are used in storage reservoir studies. A thorough examination of the basic method was made. The length of available record is critical to model parameter determination. Examination of the Monte Carlo generation technique showed that, for annual models and economic lives in the range 20 to 100 years, at least 1000 generated inflow traces are required to accurately define the distribution of storage to meet a specified demand. Storage is described by the extreme value type 1 probability distribution. Factors critical to storage requirements are the coefficient of variation and correlation of the inflow sequence, demand pattern and economic life. Except in the special case, where runoff is highly seasonal and the bulk of the demand occurs after the main runoff period, monthly generation models were found to be necessary. When a log-normal model is used, a method that preserves the properties of the observed sequence is necessary. Multiple-lag generation models were shown to be unjustified. Correlations in observed data at increasing lag result from short records.
W71-01188

FORECASTING DEMAND FOR URBAN WATER SUPPLY,
Stanford Univ., Calif. Program in Engineering Economic Planning.
For primary bibliographic entry see Field 06D.
W71-01189

USE OF A CONTINUOUS STREAMFLOW SIMULATOR IN WATER RESOURCES DESIGN,
Pittsburgh Univ., Pa., and Pennsylvania Dept. of Forest and Waters, Harrisburg.
For primary bibliographic entry see Field 05G.
W71-01210

ALLUVIAL RIVER BEHAVIOR - A FEW ASPECTS OF ITS SIMULATION IN A MODEL,
For primary bibliographic entry see Field 08B.
W71-01211

COMPUTER SIMULATION OF RIVERBED DEGRADATION AND AGGRADATION BY THE METHOD OF CHARACTERISTICS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02E.
W71-01212

DATA-REVERSIBLE SYSTEMS FOR FLOOD ROUTING,
Technische Hogeschool, Delft (Netherlands).
M. B. Abbott, and F. H. Verhoog.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 305-312, 1969. 8 p, 7 fig, 4 ref.

Descriptors: *Mathematical models, *Flood routing, Routing, Flood forecasting, Water management (Applied), River forecasting, Model studies.
Identifiers: Data-reversible mathematical models.

Reasons are given for introducing a data- reversible system for flood prediction. A particular data-reversible system is described and its special features and difficulties are outlined using examples. The construction of such a system necessitates the close interplay of several disciplines: surveying (field-interpretation) technique, hydraulics, partial differential equations, (existence theorems for a proper posing of problems), numerical analysis, and the theory of algorithms. (Knapp-USGS)
W71-01213

SIMULATION TECHNIQUES IN WATER RESOURCES SYSTEMS,
State Hydraulic Works, (Turkey). Dept. of Research.
For primary bibliographic entry see Field 02E.
W71-01215

MODELTESTS INVESTIGATING THE POSSIBILITIES OF ARTIFICIAL WATER STORAGE IN ALLUVIAL GROUNDS,
Stuttgart Univ., (West Germany).
For primary bibliographic entry see Field 04B.
W71-01216

ELECTRONIC ANALOGUES REPRESENTING NONLINEAR FLOW THROUGH OPEN CHANNELS AND FLOOD CONTROL STRUCTURES,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 08B.
W71-01217

EVALUATION OF SIMULATION MODELS FOR RIVER RUNOFF THROUGH NYQUIST PLOTS,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
Isao Yamaoka, and Mutsuhiro Fujita.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 171-180, 1969. 10 p, 14 fig, 1 tab, 4 ref.

Descriptors: *Simulation analysis, *Synethetic hydrology, *Streamflow forecasting, *Runoff forecasting, Hydrograph analysis, Hyetographs, Analog computers, Analog models, Mathematical models, Frequency analysis, Model studies.
Identifiers: Japan, Graphic procedures, Nyquist plots.

An application of the frequency-domain technique uses Nyquist plots for the evaluation or selection of simulation models for river runoff forecasting. In a river runoff system, the frequency-domain transfer function G may be defined as the ratio of the complex output function due to the riverflow hydrograph to the complex input function due to the hyetograph. The real and imaginary parts of G may easily be calculated by use of analog-computers. Nyquist diagrams, which are vector loci or polar plots for G, may ideally be used for the evaluation of mathematical models by comparison of the Nyquist plot with the observed hydrologic data. Some elementary examples are used as illustration at three stations in Hokkaido, Japan. (Knapp-USGS)
W71-01218

SIMULATION FOR THE EFFECTIVE DISTRIBUTION OF WATER RESOURCES,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
Nobumasa Kasugaya.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 9-16, 1969. 8 p, 2 fig, 6 tab.

Descriptors: *Computer programs, *Planning, *Simulation analysis, *Water management (Applied), Mathematical models, Optimization, Systems analysis, Municipal water, Irrigation water, Industrial water, Water demand, Cost-benefit analysis.
Identifiers: Water resources management.

Computer simulation may be used for appropriate distribution of water resources, using quantitative estimation of the relation between water resource and water demands, as well as cost effectiveness. A general model is based on a planning, programming, and budgeting system, and basic data for priority allocation of investments are used to forecast additional needs for water. A particular municipality was studied for illustrative calculations. In this case, the additional needs are for agricultural water, industrial water and utility service water, and the result of calculations indicate that industrial water should be given priority. (Knapp-USGS)
W71-01219

THE ROLE OF SYSTEMS SIMULATION IN WATER RESOURCE DEVELOPMENT,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
G. H. Toebes.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 447-455, 1969. 9 p, 5 fig.

Descriptors: *Systems analysis, *Simulation analysis, *Water resources development, Hydrology, Optimization, Linear programming, Dynamic programming, Digital computers, Computer programs, Cost-benefit analysis.
Identifiers: Systems simulation.

The use of methods of systems analysis in water resources studies is outlined and evaluated. In pursuing answers to questions of the value of the methods, some characteristics of water resource systems, systems simulation, systems analysis and systems synthesis are discussed. It is concluded that numerical system simulation is an ultimate use of many hydraulic research results; that simulation should be seen in the perspective of systems analysis; that systems analysis can yield priorities for hydraulic research; that knowledge of such priorities will yield improved systems synthesis; and that such syntheses will increase the relevance and use of simulation techniques in water resource development questions. (Knapp-USGS)
W71-01220

ACCURACY OF THE NUMERICAL SOLUTION FOR GENERAL UNSTEADY RIVER FLOW EQUATION,
For primary bibliographic entry see Field 02E.
W71-01223

A MATHEMATICAL MODEL OF UNSTEADY FLOW IN A NATURAL OR ARTIFICIAL WATER COURSE,
Vattenbyggnadsbyran, Stockholm (Sweden).
For primary bibliographic entry see Field 02E.
W71-01224

AMPLITUDE-DISSIPATIVE AND PHASE-DISSIPATIVE SCHEMES FOR HYDRAULIC JUMP STIMULATION,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-01225

THE CALCULATION OF FLOOD HYDROGRAPHS IN SOME RIVER SYSTEMS IN GERMANY,
Technische Hochschule, Brunswick (West Germany).
For primary bibliographic entry see Field 02E.
W71-01226

EXPERIENCE WITH THE MATHEMATIC MODEL OF THE HYDRAULIC NETWORK RIJNLAND WATER BOARD,
Waterloopkundig Laboratorium, Delft (Netherlands).

D. R. A. Stapel, and M. de Vries.
French summary included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 395-403, 1969. 9 p, 4 fig, 3 ref.

Descriptors: *Mathematical models, *Water management (Applied), Drainage systems, Land reclamation, Pumping, Urbanization, Water control, Drainage practices, Drainage engineering, Canals.
Identifiers: The Netherlands.

The various problems related to the water-management of Rijnland Water Board have led to the application of a mathematical model of the main irrigation - and drainage-system. After some general information about the setup of the mathematical model, some examples are given, demonstrating the use of the model for the solution of practical problems. About 40 sq km of Rijnland consist of lakes and many kilometers of canals, all in open connection with each other. The area has been split up in about 200 polders, but the water courses of these polders are not in open connection with the main network; pumping stations discharge the water from the polders into the network of Rijnland Water Board. The mathematical model contains the main branches of the network of Rijnland. Minor parts are neglected unless local problems of the network have to be studied in which those minor parts are important. (Knapp-USGS)
W71-01227

MATHEMATICAL MODELLING ON DIGITAL COMPUTERS AND CALCULATIONS FOR MULTI-PURPOSE UTILIZATION OF STREAMFLOW,
L. Sh. Resnikovsky.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 405-411, 1969. 7 p, 11 ref.

Descriptors: *Water management (Applied), *Optimization, *Streamflow forecasting, *Water resources development, Simulation analysis, Synthetic hydrology, Reservoir design, Hydroelectric plants, Hydroelectric power, Planning, Monte Carlo method, Stochastic processes, Water utilization.
Identifiers: USSR.

In the Soviet Union digital computers are used in optimization and modeling for the design and operation of large water resource systems and power grids having hydropower plants with large-capacity reservoirs. Results are presented of the spectral analysis of a series of observations on the streamflow of some large rivers. Methods are developed for generation of simulated streamflow for lognormal and gamma distributions on digital computers by means of Monte Carlo techniques. Cases are cited where simulated streamflow is used in the design and operation of multipurpose hydroelectric projects with long-term storages. (Knapp-USGS)
W71-01228

FLOOD FORECAST AND FLOOD CONTROL BY COMPUTER,
Ministry of Construction, Morioka (Japan).
For primary bibliographic entry see Field 04A.
W71-01229

THE ANALYSIS OF UNSTEADY FLOW IN RIVERS BY AN ANALOGUE COMPUTER,
Public Works Research Inst. Tokyo (Japan).
For primary bibliographic entry see Field 07C.
W71-01230

ON ANALYSIS OF RUNOFF MODELS,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01232

A STOCHASTIC MODEL TO SIMULATE MONTHLY RIVER FLOW SEQUENCES,
Osaka Univ. (Japan). Hydraulics Lab.
For primary bibliographic entry see Field 04A.
W71-01233

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF,
Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02A.
W71-01235

MATHEMATICAL MODEL OF THE BIG BEND WELL FIELD,
Southwestern Ohio Water Co., Cincinnati; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-01236

EXPERIMENTAL AND THEORETICAL MODELING OF SALINE WEDGES,
Tokyo Inst. of Tech. (Japan). Dept of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01239

SOME PRACTICAL ASPECTS OF TIDAL COMPUTATIONS,
Delta Project, The Hague (Netherlands). Hydraulics Dept.
For primary bibliographic entry see Field 02L.
W71-01241

A COMPUTER SIMULATION STUDY OF TRAVELTIMES OF INJECTED PARTICLES AND TIDE-WAVES IN WELL-MIXED ESTUARIES,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 02L.
W71-01252

CROSS-SECTIONAL TIME SCALES AND DISPERSION IN ESTUARIES,
California Univ., Berkeley, Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01254

DESIGN OF WATER QUALITY SURVEILLANCE SYSTEMS - PHASE I - SYSTEMS ANALYSIS FRAMEWORK,
NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.
For primary bibliographic entry see Field 05A.
W71-01264

IBP DESERT RESEARCH UNDERWAY,
Sharon Friedman.
Funded by the National Science Foundation. Bioscience, Vol 20, No 18, 15 September 1970. 6 fig.

Descriptors: *Arid lands, *On-site data collections, *Ecosystems, *Computer models, *Data storage and retrieval, Aquatic environment, Aquatic populations, Aquatic productivity, Utah, New Mexico, Arizona, Idaho, Ecology, Xerophilic animals, Xerophytes, Microorganisms, Terrestrial habitats, Deserts, Energy transfer, Productivity, Nutrients, Playas, Salinity, Soil surveys, Biomass, Fir e, Chemcontrol, Water resources, Biological properties.
Identifiers: *Validation studies, *International Biological Program (IBP), *Nutrient cycling, *Desert aquatic ecosystems, Overgrazing, Desert biome.

This is a description of the U.S. desert biome study which is part of the International Biological Program (IBP). The intent of the study is to develop methods of forecasting arid area responses to changes of all sorts, both natural and man-made. Productivity, nutrient cycling, energy flow and other desert ecosystem characteristics will be studied in both terrestrial and aquatic situations. Three major types of research are now being conducted: (1) Modeling and data bank constructs, (2) validation studies and (3) process studies. A computer model will use as a starting point a simplified ecosystem involving soil, plants and herbivores. Validation studies, serving as checks on the computer models, are currently underway on aquatic ecosystems in New Mexico, Idaho and Utah, and on 2 terrestrial systems in Arizona. The terrestrial work includes studies on plant and animal species biomass, populations and their age distributions and the impacts of fire, chemical control and overgrazing on desert plants and microorganisms. Aquatic studies will involve both playa water variations and their resulting effects on plant and animal life and other desert freshwater and saline situations. The process studies will provide specific biological data on important plant and animal species in Arizona and Idaho. (Casey-Arizona)
W71-01284

A COMPARISON OF SOME DYNAMIC, LINEAR AND POLICY ITERATION METHODS FOR RESERVOIR OPERATION,
Cornell Univ., Ithaca, N. Y.
D. P. Loucks, and L. M. Falkson.
Water Resources Bulletin, Vol 6, No 3, p 384-400, May-June 1970. 17 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Reservoir operation, Multiple-purpose reservoirs, Markov processes, Losses, Benefits, Optimization, *Mathematical models, *Linear programming, *Dynamic programming, Stochastic processes, Mathematical analysis, Computer programming, Project planning, Algorithm, Hydrology.
Identifiers: Operating criteria, Stochastic models, *Iteration method, Comparative studies, Markov chain, Markov model, Computer applications.

Three mathematical modeling and solution techniques--dynamic programming, policy iteration, and linear programming--used to derive alternative sequential operating policies for multiple-purpose reservoirs are reviewed and compared. Flows into the reservoir are assumed to be serially correlated stochastic quantities. The reservoir capacity and the storage and release targets, if any, are predetermined. The models are discrete because the continuous variables of time, volume, and flow are approximated by discrete units. The problem is to derive an optimal operating policy. Such a policy defines the reservoir release as a function of the current storage volume and inflow. The form of the solution and some advantages, limitations, and computational efficiencies of each of the models and their algorithms are compared using a simplified numerical example. Each model type yielded identical policies, but computational efficiencies differed. For relatively small problems requiring up to about 1000 constraints, total cost in man-hours and computer time favored linear programming methods. Larger problems were more adapted to dynamic programming and policy iteration techniques. (USBR)
W71-01315

SYSTEMS STUDIES OF DDT TRANSPORT,
Wisconsin Univ., Madison. Dept. of Engineering; and American Trial Lawyers Association.
H. L. Harrison, O. L. Loucks, J. W. Mitchell, D. F. Parkhurst, and C. R. Tracy.
Science, Vol 170, No 3957, p 503-508, October 30, 1970. 6 p, 2 fig, 27 ref.

Descriptors: *DDT, *Pesticide residues, Systems analysis, Ecosystems, Model studies, Trophic level, Biorhythms, Balance of nature, Pesticide toxicity, Mathematical models, Environmental effects, Distribution patterns.

Identifiers: *DDT transport mechanism, Biosphere pollution, Population response.

A systems analysis that predicts long-term impacts of DDT in ecosystems is described. The transport mechanisms of DDT, its chemical properties, its physiological effects on individual organisms, and its effects on whole populations are explained. A mechanistic model is developed to demonstrate the movement of DDT and its breakdown product DDE in an inland ecosystem. If no more DDT is added to the biosphere, its concentration in certain species at or near the top of the trophic structure could continue to rise for several years. Within the broad range of DDT and DDE toxicity, additional species may decline or disappear. At any trophic level there can be three major consequences: (1) DDT concentration may kill the members at that level, in which case the entire ecosystem will move toward a new equilibrium; (2) the concentration may not be lethal but cause reproductive failure and eventual trophic level disappearance; and (3) the concentration may have no apparent effect but the DDT will pass on to the next higher trophic level, which will be subject to the same fate of concentration. (Lang-USGS)
W71-01328

MANITOBA HYDRO CHURCHILL RIVER DIVERSION, STUDY OF ALTERNATIVE DIVERSIONS, A MATHEMATICAL MODEL.
Underwood, McLellan and Associates Ltd., Winnipeg (Manitoba).
For primary bibliographic entry see Field 04A.
W71-01338

OPERATIONS RESEARCH STUDY OF WATER RESOURCES PART I: METHODOLOGY AND PROBLEMS IN AN URBANIZED ARID ENVIRONMENT,
Arizona Univ., Tucson. Dept. of Hydrology.
Chester C. Kisiel, and Lucien Duckstein.
Water Resources Bulletin, Vol 6, No 5, October 1970, p 737-745. 1 fig, 24 ref.

Descriptors: *Water resources, *Methodology, *Operations research, *Decision making, Cities, Arid lands.
Identifiers: *Water resource management, *Urban environment.

The methodology of operations research is judged in relation to its utility to water resource management in an urbanized arid environment and to the study of worth of data for such management. Conditions for existence of a managerial problem are reviewed as is the multilevel structure of the decision process, including decisions on social goals for Western water use. Worth of data can only be judged in relation to a particular use to meet a social or managerial objective. The role of data uncertainty on the decision process is reviewed in the light of past water decisions and present and future problems. (Davis-Chicago)
W71-01364

SIMULATION/OPTIMIZATION TECHNIQUES FOR MULTI-BASIN WATER RESOURCE PLANNING,
Water Resources Engineers, Inc. Walnut Creek, Calif.
Donald E. Evenson, and Joe C. Moseley.
Water Resources Bulletin, Vol 6, No 5, October 1970, p 725-736. 3 fig, 1 tab, 9 ref.

Descriptors: *Analytic techniques, *Simulation, *Optimization, *Water resources, *Planning, Model studies, Mathematical models, Networks, Water resources development.
Identifiers: *Multi-Basin water resources planning.

A set of simulation and optimization tools capable of analyzing the development and operation of a complex, multi-basin, interconnected water resource are explained. These models provide valuable information regarding the important questions: (1) 'When should new projects be built' (2) 'How big should they be' and (3) 'How should the system be operated'. Since these tools were developed by and for practicing engineers, their applicability to real-world problems is mandatory. To assure this, testing was done on an actual proposed project, the Texas Water System. Three basic models were developed. A simulation procedure, employing a direct solution of a set of linear equations, and an optimization program are used to describe the hydraulic behavior and compute the incurred costs. A network flow code, the Out-of-Kilter Algorithm, is used in an optimization model to determine the best reservoir operating rules and the least cost flow routing. Finally, a State Development Model incorporates response surface exploration using random sampling and the method of successive perturbations to select the development plan having the least overall present value. (Davis-Chicago)
W71-01365

6B. Evaluation Process

GEOLOGY FOR PLANNING AT CRESCENT CITY, ILLINOIS.
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 03D.
W71-01111

COMPREHENSIVE REPORT FOR THE ALASKA STATE HOUSING AUTHORITY, WATER AND SEWAGE SYSTEMS IN THE GREATER JUNEAU BOROUGH, ALASKA.
Alaska State Housing Authority, Anchorage.

Available from NTIS as PB-189 131, $3.00 in paper copy, $0.95 in microfiche. PORTIONS OF THIS DOCUMENT ARE NOT FULLY LEGIBLE. May 1, 1969. 132 p.
Identifiers: *Urban planning, *Alaska, *Sanitary engineering, Urban planning, Reviews, Population, Housing, Water supplies, Costs, Sewage, Sanitary engineering, *Juneau (Alaska).

The report is divided into five parts. Previous reports and studies that have been made in this area. Data pertaining to the existing water systems in the study area, present water supply requirements and future requirements; a preliminary design is made for a water distribution and storage system; cost estimates have been prepared for all recommended improvements. Data pertaining to the volume and characteristics of sewage from the major existing sewage systems. A brief discussion of financing including federal funds that may be available. An engineering design and construction program.
W71-01156

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM.
Garver and Garver, Little Rock, Ark.

Available from NTIS as PB-191 203, $3.00 in paper copy, $0.95 in microfiche. April 1970, 126 p.
Identifiers: *Urban planning, *Arkansas, *Management planning, *Oklahoma, *Inland waterways, Harbors, *Harbors, Site selection, Industrial plants, Commerce, Economics, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning and development, *Arkansas River.

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the River region; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development, including: (1) Criteria for site selection; (2) mea
sures for preserving sites suitable for developmen
(3) the use of air and water pollution and physic
blight controls; (4) various methods of financin
including Federal assistance programs; and (5
procedures for attracting industry to port-relate
sites.
W71-01166

THE NATION'S ENGINEERING RESEARC NEEDS, 1965-1985.
Engineers Joint Council, New York.

Available from NTIS as PB-189 275, $3.00 paper copy, $0.95 in microfiche. May 26, 196 211 p.

Descriptors:
Identifiers: *Research program administration, E gineering, *Scientific research, Predictions, Nat ral resources, Energy, Environment, Transport tion, Medicine, Education, Data processi systems, Bionics, Organizations, Manageme planning, Research and development, Developin

Science is the predominant factor that influenc the allocation of national research and develo ment funds. The large federal programs of resear and development are largely dedicated to the e ploitation of new scientific opportunities. In t DOD and NASA budgets for research and develo ment, major attention is given to devices that deeper or higher or faster or farther or more acc rately. The needs of people and society are n given sufficient attention in the allocation research and development funds. The non-defer agencies do not have research and developme programs that relate broadly to their entire missi or that reflect the enormous impact of technolo on the lives of people and on political and social ganizations. The importance on maintaining a co petitive technological position to contribute growth of the national economy is not recogniz in the current allocations for research and develo ment. The fragmentation of most industries has to concentration on materials and devices with tle relationship to the technical and soc economic systems within which these materials a devices must function.
W71-01169

COMPREHENSIVE WATER AND SEW PLAN FOR BALDWIN COUNTY, ALABAMA.
South Alabama Regional Planning Commissi Mobile.

Available from NTIS as PB-190 528, $3.00 paper copy, $0.95 in microfiche. South Alaba Regional Planning Comm. November 1969, 210
Identifiers: *Sanitary engineering, *Alaba *Water supplies, Management planning, St dards, Urban areas, Rural areas, Water we Storage, Sewage, Storms, Water polluti Drainage, Statistical data, Budgets, Revie *Baldwin County (Alabama), *Regional planni Storm sewers.

The comprehensive water and sewer plan for Ba win County, Alabama, is an inventory, adequ analysis, short range development program water and sewer development plan for the wa sanitary sewers, and storm sewers in the county.
W71-01174

REGIONAL AND LOCAL LAND U PLANNING. VOLUME I. CHAPTERS THROUGH III.
Public Land Law Review Commission, Wash ton, D.C.

Available from NTIS as PB-189 410, $3.00 paper copy, $0.95 in microfiche. February 19 388 p. PLLRC Study Report No 10.
Identifiers: *Management planning, Nat resources, *Economics, *Law, Organizations, C sification, United States government, Water

plies, Forestry, Recreation, Mammals, Soils, Minerals, Roads, Decision making, Land use planning, Regional planning and development, *Public land.

Contents: Summaries of Public Land Law Review Commission study areas; Relation of resource use to land use planning and regional development; Land use planning in the Forest Service. (See also W71-01179 thru W71-01181)
W71-01178

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME II. CHAPTERS IV THROUGH XI.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 411, $3.00 in paper copy, $0.95 in microfiche. February 1970, 415 p. PLLRC Study Report No 10.
Identifiers: *Management planning, Natural resources, *Economics, *Law, Organizations, Classification, United States government, Water supplies, Decision making, Recreation, Forestry, Minerals, Agriculture, Mammals, Soils, Land use planning, Regional planning and development, Watersheds, *Public land.

Contents: Regional and local land use planning in the Bureau of Land Management; Land use planning in the National Park Service; Land use planning in the Bureau of Sport Fisheries and Wildlife; Land use planning and the Federal Water Development Project Agencies; Land use planning in the Department of Defense and the Atomic Energy Commission; Land use planning by state and local governments, and user groups. (See also W71-01178)
W71-01179

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME III. APPENDICES I THROUGH IV.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 412, $3.00 in paper copy, $0.95 in microfiche. February 1970, 339 p. PLLRC Study Report No 10.
Identifiers: *Management planning, Natural resources, *Economics, *Law, Organizations, Classification, United States government, Water supplies, Trees, Recreation, Roads, Budgets, Impact, Land use planning, Regional planning and development, *Public land.

Contents: Study methodology. The applicability of state and local land use regulation to federal lands and federal regulations to privately owned lands within the states; Appendix - Land use planning in the Forest Service; Appendix - Land use planning in the Bureau of Land Management. (See also W71-01178)
W71-01180

PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970.
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 09A.
W71-01192

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
Ulric P. M. Gibson.
Ph D Thesis, Univ. of Minnesota, June 1970. 376 p, 14 tab, 53 fig, 112 ref. OWRR Project A-018-MINN.

Descriptors: *Water resources development, *Water quality, Planning, *Management, *Legislation, Minnesota, Effluents, Withdrawals, Urbanization, *Utilization, Mathematical models, Networks, Mississippi River Basin, Costs.
Identifiers: Effluent changes, In-stream water use.

The integration of water quality management into total water resources management is generally applicable to highly developed, densely populated areas. Management must be concerned not only with the quantitative aspects but simultaneously with the qualitative aspects of water resources if optimum use is to result. Research should be undertaken to update and streamline all laws within the State pertaining to water and related resources management and also with a view to making legal terminology and definitions more closely reflect the advances in scientific knowledge; to provide the basic information necessary for the implementation of systems of charges for water withdrawals from, and effluent discharges to, bodies of water and also for in-stream water uses; to better establish the extent of the groundwater resources, the hydraulic characteristics of these resources, and the effects of urbanization upon the use, conservation, and quality of these resources. This is necessary to facilitate the recommended integrated management of ground and surface water resources; and to provide the necessary data for the development of mathematical models of the major streams and the use of the recommended communications-control networks for water quality management. In this respect the Mississippi River Basin should receive top priority. (See also W71-01358)
W71-01300

WATER SYSTEM ELEMENT STUDY.
Los Angeles Dept. of City Planning, Calif.
For primary bibliographic entry see Field 06D.
W71-01339

EFFECT OF QUALITY FACTORS ON WATER-BASED RECREATION (IN WESTERN NEVADA),
Nevada Univ., Reno. Desert Research Inst.
George A. Myles.
Available from NTIS as PB 195-778, $3.00 in paper copy, $0.95 in microfiche. Desert Research Institute Progress Report Series 3E; and Nevada Agricultural Experiment Station, University of Nevada, Bulletin 24, February 1970, 70 p., 37 tab., 4 fig., 1 ref. OWRRA-015-NEV (1).

Descriptors: *Recreation facilities, *Decision making, *Tourism, *Consumptive use, *Nevada, *Recreation demand, Attitudes, Behavior, Arid lands, Water demand, Summer, Data collections, Climatic data, Surveys, Social aspects, Lakes, Water quality, Animals, Plants, Temperature, Water sports, Benefits, Limiting factors, Waste disposal.
Identifiers: *Quality factors, *Water-based recreation.

To make the best decisions about increasing water-based recreation, it is desirable to know how visitors regard various factors that affect site quality. A 1966 summer study of visitor attidues toward site quality factors at four western Nevada lakes had the purposes of: (1) collecting physical data, including wind speed, cloud cover, air and water temperature, water odors and water coliform count of the sites; (2) correlating this data with visitor's attitudes; (3) counting the number of automobiles parked at recreation areas; (4) determining the amount of litter and trash at these sites; and (5) determining visitors' attitudes. The 25 major findings are summarized in terms of visitor preference to site and travel, group size, site setting and appeal, occupational correlations, animal and insect problems, tree preference, coliform count, parking and facility needs, concessions and cooking needs, swimming and crowding problems, advertisements, reasons for patronizing, benefits derived, time factors, litter and car counts and willingness to pay for access to facilities. The 29-part visitor questionaire is included. (Popkin-Arizona)
W71-01341

RATE OF RETURN AND BUSINESS RISK,
Paul H. Cottner, and Daniel M. Holland.
Bell Journal of Economics and Management Science, Bell Telephone Co. Autumn 1970, Vol. 1, No. 2, p 211-226.

Descriptors: *Risks, *Capital, *Investment, Profit, Economics.
Identifiers: *Rates of return.

Study findings are condensed that sought to measure the relationship between risk and rate of return. This was done in order to implement Supreme Court decisions which held that the permitted rate of return on capital of a regulated public utility should be similar to that in other business undertakings with corresponding risks and uncertainties. Defining business risk as functionally related to the variability of earnings, a number of hypotheses regarding risk and return are tested statistically, and correlations between them are discovered both for a sample of industries and invididual companies. The statistical model, however, explains only about a quarter of the variability in rates of return among industries and firms. The final section examines results in the light of recent developments in the theory of financial risk. This discussion relates to a little-understood question, the utility of uncertain events. It is important to water resources policy and planning in order to evaluate uncertainty aspects of both flood and drought damage situations and to understand the economic basis for flood insurance. (Whipple-Rutgers)
W71-01346

ECONOMICS OF WATER QUALITY MANAGEMENT.
Iowa State Univ., Ames. Dept. of Economics.
John F. Timmons, and Merwin D. Dougal.
Reprint, International Conference on Water for Peace, May 23-31, 1967, Washington, D.C., (1967). 47 p, 2 tab, 7 fig. OWRR Project A-DD1-IA (1).

Descriptors: *Economics, *Water quality, *Water quality management, Benefits, Cost-benefit analysis, Cost comparisons, Water pollution.

The three dimensional framework for water quality management includes physical economic and structural dimensions. The structural dimension includes institutional, cultural, legal influences. The three classes of fundamental relationships between water users may be characterized respectively as neutral, complementary and competitive, the third constituting the core of water quality problems. Competitive relationships are classified as (1) encroaching, (2) spatial-preclusion, (3) temporal-preclusion and (4) compensatory-continuance. Analyses of various competitive situations are analyzed and illustrated graphically, using conventional concepts of marginal analysis, the assumption that benefits can be evaluated quantitatively in money terms and the goal of maximizing net benefit. There is a discussion of the problem of evaluating benefits of water quality. Benefits which can be evaluated include additional costs to maintain usability of water of reduced quality, reduction of value of product, and value of foregone opportunities in the case of preclusion. Recreation values are categorized as debatable. The difficulty of assigning a simgle quantitative measure to pollution is recognized, and the 'pollution set' approach is mentioned. The approach of assuming a water quality objective and optimizing by means of selecting the least cost alternative is discussed briefly. An illustrative example of an Iowa stream is discussed. (Whipple-Rutgers)
W71-01349

ENVIRONMENTAL ECONOMICS OF INDUSTRIAL WATER UTILIZATION IN SOUTH CAROLINA,
Clemson Univ., S.C.
James M. Stepp.

Preprint, Paper for South Carolina Industrial Developers Association Meeting, Myrtle Beach, South Carolina, May 14, 1970. 19 p. OWRR Project A-017-SC (3).

Descriptors: *Industrial water, Electric power industry, Pulp and paper industry, Cooling water, Chemical wastes, Cost-benefit analysis, South Carolina.

Economic benefits are compared with the environmental costs of industrialization in South Carolina. The author pays particular attention to three types of wet-process manufacturing industries in the state, pulp and paper mills, textile finishing plants and chemical plants. He tries to relate the amount of water pollution caused by these industries, measured in terms of their biochemical oxygen demand (BOD), with the employment and tax benefits that they provide to the communities in which they are located. He concludes that various communities will react to the comparative costs and benfits differently, making it important to the potential industrial developer to investigate his potential community carefully. (Holmes-Rutgers)
W71-01351

RESOURCE MANAGEMENT IN THE COASTAL ZONE: THE POLICY PROBLEM,
Clemson Univ., S.C. Dept. of Agricultural Economics and Rural Sociology.
J. C. Hite, and E. A. Laurent.
(1970). 6 p. OWRR Project B-012-SC (1).

Descriptors: *Coasts, Systems analysis, Multiple purpose projects, Water resources development, South Carolina.
Identifiers: *Low Country (South Carolina).

This article attempts to set up a conceptual framework for public management of South Carolina's coastal areas. The authors first explain why the management of the coastal zone is a public or state concern and why the government is in an optimal position to serve as a 'central link between the participants in the planning process.' They conclude that systems analysis provides the best method for developing a multiple use management plan that could successfully integrate all the demands for use of the coastline. (Holmes-Rutgers)
W71-01352

ECONOMICS OF WATER QUALITY: AN APPLICATION TO THE DES MOINES RIVER BASIN.
Iowa Univ., Iowa City. Dept. of Economics.
Harold Lofgreen, and Jerald R. Barnard.
Iowa Business Digest, Vol. 40, No. 1, Feb. 1968. 11 p, 1 tab, 4 fig, 10 ref. OWRR Project A-018-IA (2).

Descriptors: *Water pollution control, *Low flow augmentation, *Waste treatment, *Pollution abatement, Regulation, Water management.

The traditional economic approach of equating marginal costs of treatment with marginal costs of damage avoided is impracticable to apply because of difficulties of evaluating damages to fish and wildlife, recreation, etc. Therefore basic water quality standards for streams have been set arbitrarily; the economists' task now being redefined as the obtaining of such standards with the minimum social costs. In their further discussion the authors assume dissolved oxygen to be the indicator of water quality, although it is realized that this may not always be the case. There is outlined the economic relationship between alternatives of effluent treatment and of flow augmentation (by reservoir storage) for the obtaining of different degrees of water quality. Data regarding unit costs of treatment are taken from publications of the Senate Select Committee (1960), applied to populations of the Des Moines River. The costs of flow augmentation on the river are taken from Corps of Engineers estimates of a proposed reservoir. The results of the treatment upon the stream are derived by means of 'rule-of-thumb' estimates of assimilative capacity. In this particular case, the combination of flow augmentation provides a lower cost alternative than treatment only. (Whipple-Rutgers)
W71-01353

ALTERNATE METHODS OF FINANCING WASTE TREATMENT FACILITIES,
Union Securities and Co., New York.
James W. Lopp.
Water and Wastes Engineering, Vol. 7, No. 3, March 1970, p. 59-62.

Descriptors: *Financing, *Government finance, Cost repayment, Economics, Water law, Pollution abatement, Water pollution control, Waste treatment.
Identifiers: *Financial alternatives, *Financing techniques, General obligation bonds, Revenue bonds.

The cost of controlling environmental pollution will be high. The government has authorized several billion dollars for federal construction grants, but it is likely that not all of it will be appropriated. Industry is moving to comply with water quality standards at a rate sufficient to meet the 1972 deadline. Municipal sewerage construction is lagging and will not meet the deadline at its present rate. Money is the major shortage, and financing is the major problem. General obligation bonds are often used, but they are restricted practically and by law. State governments are aiding municipalities directly and through special financing agencies. Industry is being encouraged to construct pollution control facilities through tax measures and state and federal aid. Joint industrial - municipal projects may be advantageous both through economy of scale, and federal - state aid. Industrial and municipal revenue bonds may also be used to construct sewerage works. Federal alternatives include direct requisitions by the FWPCA to the Treasury Department which would be funded by the sale of Second Liberty Bonds. Federal bond issuing agencies which would buy tax exempt municipal bonds are also a possibility. (Hewett-Rutgers)
W71-01355

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
Ulric P. Gibson, Conrad P. Straub, and Richard G. Bond.
Available from NTIS as PB 195-779, $3.00 in paper copy, $0.95 in microfiche. Minnesota Water Resources Research Center WRRC Bulletin 23, August, 1970. 222 p, 14 tab, 53 fig, 112 ref. OWRR Project A-018-Minn (2).

Descriptors: *Water resources development, *Water quality, *Legislation Minnesota, *Utilization, *Management, Planning, Effluents, Withdrawals, Urbanization, Mathematical models, Networks, Mississippi River Basin, Costs.
Identifiers: Effluent charges, In-Stream water use.

This study was designed to develop criteria for the management of water quality as an integral part of water resources management, and methodology for implementing such integrated management in the State of Minnesota. The concept of integrated water resources management is developed in some detail through many aspects such as the need for, and type of governmental involvement; institutional arrangements; judicial and economic policies, technical measures; the importance of socio-economic considerations; and the need to consider the wider possible range of alternatives. Approaches to this type of water resources management in three western European countries, Canada, and the United States are discussed. The existing arrangements for water resources management in Minnesota are compared with the criteria developed, weaknesses and deficiencies noted and alternative proposals made for their correction. The study provides information upon which the reorganization of water resources management in Minnesota may be undertaken. (See also W71-01300)
W71-01358

COASTAL CHANGES,
Cambridge Univ. (England). Dept. of Geography.
J. A. Steers.
In: Future Environments of North America, ed. Darling, F. Frasher and Milton, John P. (Natural History Press: Garden City, New York, 1966), p 539-551. 4 ref.

Descriptors: *Beaches, *Beach erosion, *Recreation, *Planning, *Aesthetics, *Dunes, *Reefs, Roads, Hurricanes, Sea walls, Earthquakes, Forest management, Vegetation, Land reclamation, Wetlands, Salt marshes, Oil-water interfaces, Landscaping, Tourism.
Identifiers: *Housing developments, Coys, Beach paths, Spartina, British National Trust, Canada, Scotland, Population density.

Various factors bring about coastal changes are discussed with attention given to planning for the future. Man is and will continue to be the major factor with which to contend. The demand for more accomodations on beaches inevitably threatens natural beaches and without clever landscaping even small buildings can be conspicuous. Although fortunes may be made in 'development', the nation as a whole will suffer. The car, and road systems along the coast, in addition to poorly planned paths may deteriorate dunes. Countries with lower population density have quite different problems, the author indicates, and it is suggested that we begin to take an interest in the coast from differing points of view besides sociability. Major natural factors effecting the coast are discussed. Periods of beach recovery from one hurricane are indicated to have been ten years; in another case mentioned coastal retreat initiated by a hurricane actually took place during the months following the storm. Changes on reefs and coys involving the introduction of new vegetation or tourism have made many islands more vulnerable to hurricanes, many having disappeared with storms rather than being built up by captured debris. Effects of sea walls, earthquakes, digging up plants from dunes, and removing forests, are discussed and indicated to have far reaching indirect consequences. Effects of land reclamation on wetlands, effects of oil on beaches, and means of dealing with the grass Spartina are also discussed. Constant changing of barrier islands is pointed out and development of salt marshes described. Finally, the efforts of the British National Trust to buy up unspoiled beach to be kept inviolate are praised. (Preckwinkle-Chicago)
W71-01366

RESOURCES PLANNING VERSUS REGIONAL PLANNING,
Michigan State Univ., East Lansing. School of Urban Planning and Landscape Architecture.
Sanford S. Farness.
In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P. (The Natural History Press: Garden City, New York, 1966), p 494-502.

Descriptors: *Planning, *Resource development, *Institutions, *Decision making, *Social needs, *Technology, *Economic efficiency, *Ecology, Multipurpose.
Identifiers: *Resource planning, *Urban regional planning, *Goals, Social science, Implementation.

Five types of 'regional planning' are outlined and the main negative effects of present resource planning and urban regional planning are indicated with suggestions for improved harmonization. The five major types include: resource planning-'economic development;' urban regional planning-'urban habitat;' regional facility planning-'technoeconomic efficiency;' ecological planning-'biological fitness and health;' social institution planning-'implementation.' The author's criticism

of resource planning stems from the gearing toward economic decision making implicit in the terms 'natural resource' and 'human resource.' As resources they are 'means' of instrumental value to our ends. There are, however, many more institutions, social roles, and subsystems besides economics and each has its distinctive decision method and meaning or goal. Resource planning must be pluralistic on a regional basis, and striving for a rational habitat for man realizing a constantly self-trans forming evolutionary process. Problems of regional planning include a lack of any workable consensus regarding urban form with a notion of growth indefinitely extended; the inadequate theory provided by the social sciences has not considered the various forms of social space and has often resulted in mechanistic and reductive terms. Our kind of technology and emergent human needs are indicated as coming into conflict at some critical point. Our dominant institutions in striving to comprehensively coordinate human activity are reinforcing the centralizing effects of present technology. The author concludes by stressing the need for a multi-purpose institution at regional levels which acknowledges the technoeconomic system as only a subsystem, one part of a many facted cultural system of values. (Preckwinkle-Chicago)
W71-01368

FINDINGS AND RECOMMENDATIONS.
Water Resources Council, Washington, D.C.

Report to the United States Water Resources Council by the Special Task Force, July 1970. 21 p.

Descriptors: *Water resources development, Federal government, Planning, Optimum development plans.
Identifiers: Water resources planning, Comprehensive planning.

The Special Task Force of the Water Resources Council was appointed to review and revise the evaluation practices of Federal agencies in regional or river basin planning and in planning Federal water and related land projects. The Task Force recommended a general policy statement entitled 'Principles for Planning Water and Land Resources.' Procedures were tested on different types of projects to determine whether, in interpreting the evaluation procedures, different teams 'can accomplish appropriate results and achieve reasonably uniform comparability in application.' A seminar in Feb, 1970 showed that some of the tests reflected fairly significant variation in both concept and application. Also, the multiobjective approach to planning is practical. A technical review of the Principles was studied by various Federal, state, and local agencies in June, 1970. Findings and recommendations include: (1) Multiobjectives, which are national economic development, environmental quality, social well-being, and regional development, (2) Benefits and Costs; (3) General Evaluation Principles; (4) Plan Formulation, the concept of an optimum plan; (5) Accounting System; (6) Cost Allocation, Reinbursement, and Cost Sharing; (7) National Program; (8) Participation in Planning; (9) Programs Covered; (10) Council on Environmental quality; (11) Standards; (12) Procedure; (13) Council Action. (See also W71-01370 and W71-01371). (Wray-Chicago)
W71-01369

SUMMARY, FEDERAL AGENCY TECHNICAL COMMENTS ON THE SPECIAL TASK FORCE REPORT ENTITLED 'PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS.'
Water Resource Council, Washington, D.C.

Report to the United States Water Resource Council by the Special Task Force, July 1970. 13 p.

Descriptors: *Water resources development, Federal government, Planning, Optimum development plans.
Identifiers: *Water resources planning, Comprehensive planning.

The Federal Water resource agencies commented on the special Task Force Report, entitled 'Procedures for Evaluation of Water and Related Land Resource Project,' in June 1969. These comments are condensed as follows. The concept of multiobjectives to expand project formulation and evaluation studies for uniform and equitable consideration of all relevant planning objectives is endorsed. The discussion on plan formulation is faulted for providing only the vaguest notion of how to proceed with formulating a plan to meet multiple objectives. Also, since only the objective of national economic development can be analyzed by standard benefit-cost techniques, the other three objectives will suffer. The use of benefits and costs analysis in planning requires more consideration, especially to devise uniform measurement standards. A more explicit definition of 'national economic benefits' would be valuable in the report. Benefit evaluation procedures need to be standardized so that the values do represent positive net income benefits. The report perpetuates the difficulty of separating flood control and drainage functions. Conventional benefit-cost analysis at present is an insufficient means of evaluation for the environmental objectives. The objective of providing for social well-being is new in concept and requires long-term attention. Secondary benefits should be computed in all areas where basic conditions exist and not limited to so-called redevelopment areas. Examples are needed to explain the use of accounting tables. Appropriate guidelines are needed for regional delineation. The evaluation procedure may be applicable only to Federal projects. (See also W71-1369 and W71-01371) (Wray-Chicago)
W71-01370

SUMMARY AND INDEX, PUBLIC RESPONSE TO THE SPECIAL TASK FORCE REPORT ENTITLED 'PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS.'
Water Resources Council, Washington, D.C.

Report to the United States Water Resources Council by the Special Task Force, July 1970. 7 p, 3 append.

Descriptors: *Water resources development, Water management, Planning.
Identifiers: *Water resources planning, Comprehensive planning.

The opinions of participants in the August-September 1969 public hearings on 'Procedures for Evaluation of Water and Related Land Resource Projects' are presented in this report. Many said the Task Force report should be rewritten to simplify, clarify, and establish explicit guidelines. Other groups, especially conservationists, felt the report was biased in favor of construction and would be able to search for more benefits for marginal projects. Local government officials, port authorities, etc. however, were pleased with the innovations. There were some disagreement on whether the national account or environment should be weighed as benefits. The benefit-cost system was viewed from opposing positions by conservationists and city officials. In considering secondary benefits, one group saw little value in measuring them, while the other group felt secondary benefits should be stressed. Testimony on interest rates also covered a wide spectrum. Some reviewers commented that construction agencies should be separated from the planning because of their difficulty in making unbiased analyses of favorable and adverse effects. Suggestions were made to use economic analysis in other Federal programs; to include solvage or residual values in resource planning; to include cost allocation and repayment policy; to revise the recreation day values upward; and to require mitigation protection for wildlife. (See also W71-01369 and W70-01370) (Wray-Chicago)
W71-01371

NATURAL RESOURCES, AND ECONOMIC DEVELOPMENT: THE WEB OF EVENTS, POLICIES AND POLICY OBJECTIVES,
Resources for the Future, Inc., Washington, D.C.
Joseph L. Fisher.
In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P. (The Natural History Press: Garden City, New York, 1966), p 261-276. 1 tab, 5 ref.

Descriptors: *Natural resources, *United States, *Social aspects, *Economic impart, *Technology, Multiple purpose, Conservation, Ecology, Aesthetics.
Identifiers: *Economic development, *Events, *Policies, Policy objectives, Multiple resource approach, Canada.

Economic development and use of natural resources in the United States and Canada are reviewed in terms interrelated events, policies, and policy objectives. Reviewed first are highlights in recent U.S. History relating to natural resources. Discussion centers around the leadership of Theodore Roosevelt with Gifford Pinchot and the next major period of thinking during the Depression years up to the present. Major social, economic and technical forces underlying events and policies noted are: population growth, internal shifts of population, growth of recreation; increase of urban land, greater demand for water and pollution abatement, improving agricultural techniques and source of fuel, and finally social characteristics with greater per capita income and homogenization and equalization of classes and regions. Broad policy objectives considered for resources include a rising level of welfare made up of economic, technologic, and aesthetic parts; aid to poorer countries striving for resource and economic development; and national security. The author suggests that testing of specific policies against these objectives would be useful in giving greater direction and consistency to actions. Finally, speculations regarding the future are made. Conclusions are that: age-old concern for resource shortage seems to boil down to a management problem resource quality is becoming more important, planning for several decades ahead interrelating resources and the whole economy of countries and regions should be encouraged, behavioral and institutional changes should contain the problem of over population, and more comprehensive programs for resource conservation will have to be worked out for the future emphasizing multiple-purpose, multiple-resource approaches. (Preckwinkle-Chicago)
W71-01373

REGIONAL VERSUS INTER-REGIONAL EFFICIENCY IN RESOURCE ALLOCATIONS,
Michigan Univ., Ann Arbor.
Gunter Schramm.
Pap, 9th Annu Meet, West Reg Sci Ass, San Diego, Calif. Feb-Mar 1970. 18 p, 2 fig, 28 ref.

Descriptors: *Resource allocation, Resource development, Compensation, Inter-basin transfers, Transfer, *Efficiencies, Water rights, Intangible benefits, Water allocation (Policy), *Water transfer, Natural resources, Costs, Economic efficiency, Economics, Benefits, Bibliographies, Benefit sharing, Optimum development plans, Water resources, Planning.
Identifiers: Regional planning, *Benefit-cost analysis.

The question is investigated of whether introduction of compensation payments for transfer of resources between independent regions having unequal endowments of resources such as water would lead to efficient allocation and utilization of the resources. The basic assumption of the analysis is that different regions have jurisdiction or ownership rights over their resources and determine existing and future utilization. The analysis was conducted in terms of usual benefit-cost terminology, with net benefits referring to the present value of the sum of public and private total benefits minus the sum of public and private total costs. The analy-

sis shows that the range and magnitude of opportunity costs are different for different regions, and the sum of efficiency solutions of individual regions is not necessarily equal to the optimum interregional efficiency solution. Problems of defining relevant regional and interregional benefits are discussed. The analysis shows that regional ownership of resources is likely to result in interregional inefficiency and that a system of compensation payments will reduce but not eliminate these inefficiencies. (USBR)
W71-01385

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01397

PARTICIPATION IN WATER BASED RECREATION BY NEVADA RESIDENTS AND TOURISTS,
Nevada Univ., Reno. Div. of Agricultural Economics and Education.
George A. Myles.
Nevada Agricultural Experiment Station, University of Nevada, Bulletin 21, September 1969. 40 p, 26 tab, 1 fig, 8 ref. OWRR A-019-NEV (2).

Descriptors: *Water demand, *Water sports, *Tourism, *Consumptive use, *Nevada, Recreation demand, Attitudes, Decision making, Behavior, Arid lands, Recreation facilities, Data collections, Surveys, Statistics, Camping, Lakes, Streams.
Identifiers: *Water-based recreation, Reno (Nevada), Las Vegas (Navada).

Out-of-state tourists and Nevada residents are visitors to Nevada's recreation sites. Residents in the Reno and Las Vegas areas were questioned by mail and out-of-state tourists passing through Reno were interviewed to provide information on water based recreational attitudes. Characteristics of visitors with nonvisitors are compared. Estimates of percentage of the resident and tourist populations who visit and reasons for visiting or not visiting water based recreation sites are given. This information supplements the data collected in on-site interviews to provide a better understanding of factors which affect participation in water recreation. The first part of the report is concerned with residents and the second part with out-of-state tourists. Summaries of 15 conclusions about Nevada urban residents and 8 conclusions about tourists to northwestern Nevada are presented for 1967. These summaries are concerned with frequency and recurrence of visit, car and boat ownership, time spent, preferred activities, facilities and attractions, reasons for not visiting, improvement suggestions and financial willingness to support the sites. (Popkin-Arizona)
W71-01407

MINIMAL COST ESTIMATION FOR LAKEFRONT SEWAGE SYSTEMS,
New Hampshire Univ., Durham. Water Resources Research Center.
Kenneth W. Norton, and Robert H. Forste.
Available from NTIS as PB-195 782, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Center, Technical Working Paper No. 1, Jan. 1969. 20 p, 1 tab, append. OWRR Project A-008-NH (6).

Descriptors: *Estimated costs, *Estimating, Feasibility, Water pollution control, Pollution abatement, Economics, Project feasibility, Economic feasibility, Sewage disposal, Project planning.
Identifiers: *Minimal cost estimation, Lakefront sewerage.

The objectives of this paper were to estimate the minimal cost of a municipal sewerage system for the Pawtuckaway Lake area of Nottingham, N. H., and to develop a method of estimating minimal cost that would be applicable in other similar situations. Equations for determining the diameter of the main sewer and the length of required sleeve pipe were developed in terms of the percentage of land suitable for development, the development density of shore front lots, and the development density of back lots. Items which were included in the cost estimate were: a sewage treatment plant, pumping stations, manholes, manhole covers, major pipes including excavation and backfill, and four inch sleeve pipe also including excavation and backfill. The total minimal cost of these items was expressed as the summation of all the unit costs times their respective required quantities. Although the method was developed for the Pawtuckaway Lake area, a generalized formula is given which may be applied to estimate the minimal cost of other lakefront sewerage systems. (Hewett-Rutgers)
W71-01410

UNITED STATES V WEST VIRGINIA POWER CO (VALUATION OF PROPERTY CONDEMNED FOR DAM SITE).
For primary bibliographic entry see Field 06E.
W71-01457

ANALYSIS OF RECREATIONAL USE OF SELECTED RESERVOIRS IN CALIFORNIA,
California Univ., Davis. Dept. of Agricultural Economics.
Victor S. Pankey, and Warren E. Johnston.
Available from NTIS as AD-701 949, $3.00 in paper copy, $0.95 in microfiche. Army Engineering District, Sacramento, July 1969. 42 p, 14 ref. Contract DAC-05-67-C-0036.
Identifiers: *Recreation, *California, *Lakes, Recreation, Public opinion, Group dynamics, Mathematical prediction, Performance (Human), Mathematical models, Regression analysis, Population, Sociometrics, Economics, Quality control, Periodic variations, Reservoirs, Socioeconomic status.

The study is based on recreation use data collected at seven Corps of Engineers reservoirs in California. The two basic objectives of the study were to evaluate and attempt to isolate factors influencing recreation use, and develop recreation use prediction models. The technique used is multiple linear regression. The study generalizes the 'Clawson-Hotelling' prediction model for estimating demand at selected reservoirs in California using distance from the site as a proxy for price. Alternative prediction models employ distance zones about sites or county of origin of users of each site, and results from the alternative models are compared. The various factors or variables examined included socio-economic variables relating to income, age, education, urbanization, and population of the zones (counties) and certain site specific variables to differentiate either quality and/or quantity of the recreation experience at reservoirs. Findings of the study relate only to recreation use prediction at reservoir sites in California. However, these findings will provide the bases for development of more sophisticated prediction models having wider application and also for further studies in the determination of the economic value of water-based recreation.
W71-01503

RECREATIONAL DEVELOPMENT OPPORTUNITIES OF THE INTRACOASTAL WATERWAYS IN NORTH CAROLINA, SOUTH CAROLINA AND GEORGIA.
Coastal Plains Regional Commission, Washington, D.C.

Available from NTIS as PB-189 189, $3.00 in paper copy, $0.95 in microfiche. Coastal Plains Regional Commission, November 1969, various pagings. 66 tab, 17 fig.
Identifiers: Urban planning, Inland waterways, *Inland waterways, *Recreation, Recreation, Economics, Traffic, Marine engineering, Boats, Buildings, Population, Georgia, North Carolina, South Carolina, Maps, Tables, Coastal plains region, Area planning and development, Land use.

Contents: Summary of findings; Promotion of intracoastal waterway; Specific investment opportunities; Holiday afloat; Dixie bateau; Future development; Financing sources; Implementation program.
W71-01514

PHYSICAL RESOURCES.
Capital District Regional Planning Commission, Albany, N.Y.

Available from NTIS as PB-190 176, $3.00 in paper copy, $0.95 in microfiche. December 1969, various pagings. 95 ref.
Identifiers: *Urban planning, New York, *Natural resources, Inventory, Terrain, Climatology, Air pollution, Water supplies, Soils, Water pollution, Minerals, Agriculture, Land use, Urban planning and development.

The physical resource inventory and analysis study was undertaken by Metcalf and Eddy, Inc., for the Capital District Regional Planning Commission (CDRPC) as one of the studies in its initial work program. It is intended to formulate the ground work for the eventual completion of a future development plan for the 2,219 square mile Capital District Region. The intention of this study is to inventory data on the significant natural physical features of the Region and analyze the role they play with the Capital District Region. Maximum use has been made of existing studies and expert knowledge of conditions in the Region. New research has been added only where necessary.
W71-01525

DEVELOPMENT BENEFITS OF WATER RESOURCE INVESTMENTS,
Washington Univ., St. Louis, Mo.
Charles L. Leven.
Available from NTIS as AD-704 714, $3.00 in paper copy, $0.95 in microfiche. Army Engineer Institute for Water Resources, IWR Report 69-1, November 1969. 443 p. Contract DA-49-129-CIVENG-66-11.
Identifiers: *Water supplies, Economics, Labor, Employment, Wages, Industries, Mathematical models, Water resources, Water consumption, *Water resource investments, Economic impact.

The project focuses on the question of the determination and evaluation of developmental benefits of water resource investments. The study recognizes that in addition to producing services whose value to users would be benefits of an investment project, that the project itself might produce additional changes in the economy of the region in which it was located. In other words, in addition to the value of water resource services to water service users (primary benefits) it is recognized that water resource investments might cause an enhancement of a region's economy by way of inducing the expansion or formation of economic activities in that area. (See also W71-01531)
W71-01530

DEVELOPMENT BENEFITS OF WATER RESOURCES INVESTMENTS. APPENDICES,
Washington Univ., St. Louis, Mo.
Charles L. Leven.
Available from NTIS as AD-704 715, $3.00 in paper copy, $0.95 in microfiche. Army Engineers Institute for Water Resources IWR Report 69-1-A, November 1969. 339 p. DA-49-129-CIVENG-66-11.
Identifiers: *Water supplies, Economics, Labor, Employment, Wages, Industries, Mathematical models, Water resources, Water consumption, *Water resource investments, Economic impact.

Contents: The efficacy of labor migration with special emphasis on depressed areas; The influence of community characteristics on the relationship of unemployment changes to employment changes in major labor market areas; Programs for computerized location models for assessing regional shifts in industrial location; Economic base and input-output models and their role in regional analysis; Combination transforms for the aggregation of interregional commodity flows, and Interindustry analysis tables for Appalachia, Ozarks and rest of the United States. (See also W71-01530)
W71-01531

THE WATER CRISIS,
For primary bibliographic entry see Field 06E.
W71-01566

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT OF THE COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 90th CONGRESS, 1st SESSION.
For primary bibliographic entry see Field 06E.
W71-01605

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

GRAZING VS. WHEAT PRODUCTION ON MARGINAL UTAH CROPLAND,
Utah State Univ., Logan. Dept. of Range Science.
For primary bibliographic entry see Field 03F.
W71-01297

RATE OF RETURN AND BUSINESS RISK,
For primary bibliographic entry see Field 06B.
W71-01346

THE COST OF IMPROVING WATER QUALITY IN THE GREAT LAKES,
State Univ. of New York, Syracuse. Water Resource Center.
Robert D. Hennigan.
Water and Wastes Engineering, Vol. 6, No. 1, January 1969. p A-28-A-31, 1 tab.

Descriptors: *Great Lakes, *Great Lakes Region, *Estimated costs, *Total costs, Water quality, Water quality control, Costs, Water pollution control, Pollution abatement, Planning, Federal government, Local government, Institutions.

About 11 billion gallons of water are drawn from the Great Lakes each day. Nearly all of this is returned as treated or untreated waste water including nearly every imaginable type of natural, urban and industrial pollution. Water quality has deteriorated considerably with concomitant upset of the ecology, and decrease in recreational usefulness, etc. A great deal of planning, regulation, construction and money is required to stop the deterioration of the Great Lakes. The total five year cost for water quality improvement is approximately $3.7 billion. About 95% of this is for construction and operation of municipal and industrial waste treatment facilities. A 30% federal, 30% state, and 40% local share of treatment facilities cost is a fair allocation if no ceilings exist on individual projects of available funds. When the cost of sewer construction is included, the allocation becomes 15% federal, 15% state, and 70% local because sewer costs are generally not eligible for federal aid. The federal government, state and local agencies need a focus, staff, budget, and independence to provide executive responsibility. If the proper institutional arrangements are not forthcoming, great sums of money will be wasted and goals not realized. (Hewett-Rutgers)
W71-01354

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01397

THE PUBLIC TRUST IN TIDAL AREAS: A SOMETIME SUBMERGED TRADITIONAL DOCTRINE.
For primary bibliographic entry see Field 06E.
W71-01548

CITY OF PHILADELPHIA V STANDARD OIL CO (RIPARIAN OWNER'S LIABILITY FOR RENT FOR USE OF CITY'S BULKHEAD).
For primary bibliographic entry see Field 06E.
W71-01630

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT--WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
For primary bibliographic entry see Field 06E.
W71-01635

6D. Water Demand

FORECASTING DEMAND FOR URBAN WATER SUPPLY,
Stanford Univ., Calif. Program in Engineering Economic Planning.
Peter W. Whitford.
Available from NTIS as PB-195 664, $3.00 in paper copy, $0.95 in microfiche. Project on Engineering-Economic Planning, Report EEP-36, September 1970. 221 p, 14 fig, 23 tab, 119 ref. OWRR Project C-1635 (No 3150) (2).

Descriptors: *Forecasting, *Future planning (Projected), *Domestic water, Water demand, Water utilization, Appliances, Sprinkling, Pricing, Maryland, Missouri, Arizona, Washington.
Identifiers: *Metropolitan studies, *Alternative futures, Water use per capita, Baltimore, Kansas City, Phoenix, Seattle.

Conventional methods of forecasting future demand for municipal water supply were found to give undue emphasis to historical rates of use, to ignore many relevant factors, and to fail to distinguish between components of use. This study is concerned with only the residential part of urban water use, the components of which, such as lawn sprinkling, toilet flushing, washing machines or air conditioning, are discussed in turn with consideration given to price sensitivity and possible future trends. A forecasting model or framework for analysis is proposed. Six factors influencing future water use are: regulations on the water use of appliances; the type of pricing policy that is adopted; policy on public education; the housing patterns of the future; the cost of supply; changes in the technology of use. Two or three outcomes are considered for each of these factors and combinations of these outcomes form alternative descriptions of the future. Four case studies are used (Baltimore, Kansas City, Phoenix and Seattle) and, for each case, a 'baseline' estimate is made which reflects past trends. Then the effect on water use of each alternative future is estimated. Probabilities are subjectively assigned to each outcome, allowing a probability distribution of future water demand to be drawn.
W71-01189

ALMO WATER CO V JONES (RIGHT TO APPROPRIATE WATER).
For primary bibliographic entry see Field 06E.
W71-01302

KENNILWORTH MANAGEMENT CO V CITY OF ITHACA (REFUSAL OF CITY TO SUPPLY WATER UNDER CONTRACT).
For primary bibliographic entry see Field 06E.
W71-01307

WATER SYSTEM ELEMENT STUDY.
Los Angeles Dept. of City Planning, Calif.

Staff report, August 1968. 17 p. City Plan Case 19716.

Descriptors: *City planning, *Planning, *Long-term planning, *Water resources development, *Water supply, Colorado River, Colorado River aqueduct, Los Angeles aqueduct, Groundwater recharge, Water spreading, Water tanks, Water policy, California.
Identifiers: *Los Angeles (Calif), *Comprehensive master plan, Owens River, Los Angeles River, California aqueduct.

The Los Angeles City Planning Department, in collaboration with other concerned City agencies, is developing a Comprehensive Master Plan. The Water System Element is one of 22 technical elements of the present Plan scheduled for revision. The publication describes the present source of water from groundwater and surface lakes and streams, including the Colorado, Owens and Los Angeles Rivers. Water quality, storage reservoirs, and distribution facilities are discussed. Future water needs, sources, and facility needs to the year 2000 are outlined. The annual water consumption in Los Angeles City is expected to increase from the present 169 billion gallons to 292 billion gallons. In addition to a second Los Angeles aqueduct and increased use of Colorado River water, the City will receive Northern California water via the California Aqueduct, about 1971. The world's largest plant for converting sea water, planned by the federal government in conjunction with local utility companies, is mentioned. It is planned for construction on an island to be constructed off the coast of Orange County. The feasibility of using reclaimed waste water for irrigation, industry, and groundwater replenishment is being examined. A statement of policy of the City Planning Commission concerning the Water System Plan is included. It covers the purpose and objectives of the plan, standards, and criteria. The features of the plan are discussed briefly. The Planning Commission's policy on water storage tanks is also discussed. (Poertner)
W71-01339

EFFECT OF QUALITY FACTORS ON WATER-BASED RECREATION (IN WESTERN NEVADA),
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 06B.
W71-01341

VERMONT SHADE ROLLER CO V BURLINGTON TRACTION CO (INTERPRETATION OF WATER RIGHTS UNDER CONTRACT).
For primary bibliographic entry see Field 06E.
W71-01382

ENERGY METABOLISM AND PULMOCUTANEOUS WATER LOSS OF AUSTRALIAN HOPPING MICE,
California Univ., Irvine. Dept. of Population and Environmental Biology; and Monash Univ., Clayton (Australia). Dept. of Zoology.
Richard E. MacMillen, and Anthony K. Lee.

Comparative Biochemistry and Physiology, Vol 35, p 355-369, No 2, 15 July 1970. 5 fig, 3 tab, 23 ref. NSF Grant GB-5618.

Descriptors: *Temperature, *Physiological ecology, *Xerophilic animals, *Thermal stress, *Cooling, Laboratory tests, Arid lands, Thermal conductivity, Oxygen demand, Burrows, Animal physiology, Water loss.
Identifiers: *Fossorial animals, *Pulmocutaneous water loss, *Hyperthermia, *Australian hopping mice, *Basal metabolic rate (BMR), Ambient temperature.

Changes in body temperature (T sub B), oxygen consumption (BMR) and pulmocutaneous water loss (PWL) with changes in ambient temperatures (T sub A) were measured in 2 species of captured Australian hopping mice (Neotomys alexis and Neotomys cervinus). Both species maintained a fairly constant T sub B below 37 degrees C. and at or above that temperature became hyperthermic. Both BMR and PWL were inverse linear functions of T sub A. Thermal conductance is inconstant below thermal neutrality and the BMR is below predictable values based on body size. Apparently both species must rely upon hyperthermia during periods of high T sub A. This occurs in conjunction with lower heat production as indicated by depressed BMR values. It is speculated that burrow conditions are often characterized by a high T sub A and high relative humidity, reducing the possibilities of evaporative cooling. These concepts are important in understanding the adaptive physiology of sert animals to extreme fluctuations of temperature and water availability in their environment. (Casey-Arizona)
W71-01401

PARTICIPATION IN WATER BASED RECREATION BY NEVADA RESIDENTS AND TOURISTS,
Nevada Univ., Reno. Div. of Agricultural Economics and Education.
For primary bibliographic entry see Field 06B.
W71-01407

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (EXCESSIVE WITHDRAWAL OF WATER FROM RIVER).
For primary bibliographic entry see Field 06E.
W71-01422

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (LICENSING OF POWER COMPANIES).
For primary bibliographic entry see Field 06E.
W71-01564

DOLL V BLITZ (RIGHT TO REASONABLE DOMESTIC USE OF SPRINGWATER).
For primary bibliographic entry see Field 06E.
W71-01569

6E. Water Law and Institutions

MEDDOCK V NATIONAL TRANSIT CO (LIABILITY FOR POLLUTION OF SPRING BY LEAKAGE OF OIL FROM PIPELINE).

161 A 628-630 (Pa 1932).

Descriptors: *Pennsylvania, *Water pollution, *Oil, *Leakage, Pollutants, Springs, Impaired water quality, Water pollution sources, Oil wastes, Oily water, Pipes, Pipelines, Pipe flow, Conduits, Judicial decisions.

Plaintiff brought an action in trespass to recover damages for defendant corporation's contamination of the waters of a spring on his land. Plaintiff contended that defendant, in transporting crude oil through pipelines extending across plaintiff's land, negligently maintained the pipes so as to allow a leak to develop, from which oil escaped and contaminated the spring. Defendant contended that it was not strictly liable for leakage, but instead was only liable if it had failed to repair the leaks. Defendant contended that it had in fact immediately repaired the leaks and thus was not liable. The court held that under applicable statutes defendant was to be held liable not for the leaks, but only for a failure to repair the leaks. However, the court found sufficient evidence to indicate that the leaks had not been immediately repaired and that a large quantity of oil had escaped which had contaminated the spring. Defendant was thus liable for plaintiff's damages. (Snow-Florida)
W71-01115

SLOSS SHEFFIELD STEEL AND IRON CO V NANCE (LIABILITY FOR BLOCKING NATURAL DRAINAGE OF SURFACE WATERS).
113 So 50-52 (Ala 1927).

Descriptors: *Alabama, *Embankments, *Surface drainage, *Obstruction to flow, Legal aspects, Judicial decisions, Damages, Ponds, Surface waters, Boundaries (Property), Earth dams, Channels, Channel flow, Cultivated lands, Water spreading, Repulsion (Legal aspects), Natural flow, Rain, Rain water, Impoundments.

Plaintiff farmer sued defendant steel company for damages caused by the impounding of surface water on plaintiff's property by the maintenance of an embankment on defendant's land. The embankment which created a pond on plaintiff's land was constructed before defendant acquired its property. The natural drainage of surface water was from plaintiff's to defendant's property. The Supreme Court of Alabama, in reversing a lower court decision for plaintiff, held that the evidence was not sufficient to support the judgment. The court remanded the case, however, holding that the evidence did tend to show that the pond caused the settling and filling of a channel which carried the drainage from plaintiff's land. This caused the land to remain wet and unsuitable for cultivation. This result, caused by defendant's embankment, created a private nuisance and a cause of action and breached the prevailing law that lower lands are subject to a servitude for the natural drainage of higher lands. However, defendant could only be held liable if he maintained the embankment with knowledge of the nuisance it created. (Morris-Florida)
W71-01122

HAWKEYE PORTLAND CEMENT CO V WILLIAMS (EASEMENTS FOR WATER SUPPLY).
239 NW 120-123 (Iowa 1931).

Descriptors: *Iowa, *Easements, *Usufructuary right, *Water supply, Watercourses (Legal), Pipes, Springs, Land tenure, Surplus water, Overflow, Natural flow, Pumps, Dams, Reservoirs, Legal aspects, Judicial decisions, Water utilization, Ravines, Relative rights.

Plaintiff cement company sought an injunction to restrain defendant from interfering with its water supply which originated on defendants' land. Plaintiff had entered into an agreement with defendants' grantor for use of the overflow from two springs, and had constructed a tank, pump and pipes to convey such water. However, plaintiff's employees, with the consent of defendants' grantor, later began to cross into the grantor's premises and draw water from one of the springs. When defendants acquired the property, they endeavored to stop plaintiff from taking water in any manner from defendants' alnd. The Supreme Court of Iowa affirmed but modified the trial court's decree granting plaintiff an injunction. On appeal, defendants conceded plaintiff's rights under the express agreement with their grantor but challenged the right of plaintiff's employees to enter and carry water from defendant's premises. There was no evidence that plaintiff had acquired an easement for its employees to carry water from defendants' lands, and the court modified the trial court's decree which had been based in part on such an easement. (Duss-Florida)
W71-01123

WHARTON V EMPIRE MFG CO (PERMANENT DAMAGES WHERE DEFENDANT OFFERS TO ABATE NUISANCE).
146 SE 867-868 (NC 1929).

Descriptors: *North Carolina, *Ponding, *Damages, *Adjudication procedure, Legal aspects, Remedies, Judicial decisions, Drainage, Lumbering, Industries, Land, Real property, Crops, Puddling, Industrial plants, Water injury.

Defendant's operation of a lumber mill on property adjacent to plaintiff's caused ponding of water on and consequent damage to plaintiff's property. Defendant offered to abate the nuisance. Plaintiff brought action to recover damages which occurred up to the time of the trial and permanent damages. The issues of damages for temporary and permanent injury were submitted to the jury, which arrived at a verdict assessing defendant for present and future damages. Defendant contended that, in the light of its offer of abatement, the issue of permanent damages should not have been submitted to the jury. The Supreme Court of North Carolina reversed the judgment of the lower court for plaintiff as to permanent damages. There was no permanent appropriation of plaintiff's land, and therefore he was not entitled to recover permanent damages. (Dye-Florida)
W71-01131

SHEMMEL V KRAMER (LIABILITY FOR DIVERSION OF SURFACE WATER).
228 NW 561-562 (Iowa 1930).

Descriptors: *Iowa, *Surface water, *Surface drainage, *Diversion, Drainage, Ditches, Water courses (Legal), Land tenure, Dams, Watersheds (Divides), Natural flow, Topography, Judicial decisions, Legal aspects, Surface runoff, Natural streams, Realtive rights, Adjudication procedure.

Plaintiff landowner sought to enjoin defendant landowner from diverting surface water from its alleged natural course onto plaintiff's land. Defendant contended that the natural flow of surface water was onto plaintiff's land. The trial court found for defendant, and the Supreme Court of Iowa affirmed, holding that plaintiff failed to sustain the burden of proof of establishing his case by a preponderance of the evidence. (Duss-Florida)
W71-01134

CREECH V UNITED STATES (IMPERVIOUS LEVEE NOT THE CAUSE OF OVERFLOW AND INCREASED WIND TIDES).
60 F Supp 885-896 (Ct Cl 1944).

Descriptors: *United States, *Eminent domain, *Flood control, *Levees, Crops, Compensation, Damages, Florida, Canals, Drainage, Islands, Lakes, Drainage districts, Drainage water, Ditches, Spoil banks, Roads, Hurricanes, Rivers and Harbors Act, Federal government, Floodgates, Navigation, Overflow.
Identifiers: *Lake Okeechobee.

Plaintiff brought suit for damages to their growing crops allegedly caused by the increased water level and wind tides of Lake Okeechobee. Plaintiff farmers grew crops on certain islands in the lake. Defendant, pursuant to special act, built a new, impervious levee to maintain the water level in the lake at 17.6 feet. This level had been determined as the mean average, and most desirable, level at which to maintain the lake. Plaintiffs alleged that the construction of the levee and the resultant overflow of their lands by the increased water level was a deprivation of property without due process of law. The Court of Claims stated that the evidence had

not established plaintiffs' claims. The construction of the levee for flood control and navigation had no appreciable effect on the height of the waters of the lake or on the wind tides. (Barnett-Florida)
W71-01138

BODCAW LUMBER CO V KENDALL (OWNERSHIP OF NON-NAVIGABLE STREAMBED).

108 So 664-666 (1926).

Descriptors: *Louisiana, *Ownership of beds, *Non-navigable waters, *Leases, Oil, Mining, Navigable waters, Grants, Beds, Bed under water, Federal government, Patents, Bayous, Obstruction to flow, Meanders, Legal aspects, Judicial decisions, Streambeds.

Plaintiff landowner brought action to quiet title to certain lands and to have a lease held by defendant for the purpose of mining on said land and in a streambed annulled. Defendant had secured the lease from the state. Plaintiff contended the state could not grant such a lease since the bed of the stream to which the lease attached was in a non-navigable channel. The court found that the stream was, and had been at the time of the granting of the lease, a non-navigable stream, that the state did not own such stream, and that the state could not, therefore, grant such a lease therein. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-01139

MERIWETHER SAND AND GRAVEL CO V STATE (POLLUTION OF STREAMS).
26 SW2d 57-63 (Ark 1930).

Descriptors: *Arkansas, *Water pollution control, *Industrial wastes, *Water quality, Water pollution effects, Discharge (Water), Drainage, Streams, Obstruction to flow, Mud, Riparian rights, Riparian land, Riparian waters, Relative rights, Reasonable use, Public rights, Watercourses (Legal), Domestic water, Fish conservation, Fishing, Swimming, Mining, Damages, Legal aspects, Judicial decisions, Remedies.

Plaintiff state and two private parties sought to enjoin defendant company from discharging washings from its gravel beds into a creek. The private parties were riparian owners along the stream. They alleged that defendant's pollution had damaged their land and rendered the streamwater unfit for domestic or agricultural use. Plaintiff state asserted that defendant's acts had rendered the stream unfit for fishing and breeding of fish. The trial court found for plaintiffs. On appeal, defendant contended that: (1) the private individuals were barred from suit by statute of limitations and laches; (2) relief should not have been granted because the damages were slight; (3) the relief would work a hardship on defendant; (4) defendant's business was of great value to the state; and (5) the trial court's decision constituted a dangerous precedent. The Supreme Court of Arkansas affirmed. The cause of action was not barred by the statute of limitations or laches because the injury was progressive and continuing and could not have been foreseen at its initiation. The evidence showed that defendant's acts transformed the stream into one unfit for fishing and breeding of fish. The court held that the public's right was superior to the private right of defendant. (Duss-Florida)
W71-01147

PITTARD V SUMMEROUR (ENJOINING OF ALLEGED NUISANCE).
182 SE 20-21 (Ga 1935).

Descriptors: *Georgia, *Water pollution sources, *Streams, *Wastes, Water pollution effects, Abatement, Industrial wastes, Waste disposal, Legal aspects, Judicial decisions, Non-consumptive use, Chemical wastes, Byproducts, Organic matter, Waste treatment, Separation techniques, Remedies, Adjudication procedure.

Plaintiff lower riparian owners sought an action to prevent defendant tanners from constructing a tanning facility on a stream that flowed from defendants' land through plaintiffs' farms. Plaintiffs contended that the chemicals and wastes which would result from a tanning facility would pollute the stream's water and make it unfit for domestic use. Defendants contended that no pollution would result from the proposed tanning facility and that adequate safety precautions would be taken. The Supreme Court of Georgia held that an injunction could not be issued against an alleged nuisance where no adequate evidence was given to show the certainty of the nuisance. (Quesada-Florida)
W71-01148

PECK V ALFRED OLSEN CONST CO (STATE'S INTEREST IN NAVIGATION PARAMOUNT TO RIPARIAN RIGHTS).
245 NW 131-138 (Iowa 1932).

Descriptors: *Iowa, *Riparian rights, *Navigation, *Relative rights, State governments, Lakes, Navigable waters, Ownership of beds, Riparian land, Docks, Piers, Riparian waters, Administrative agencies, Administrative decisions, Eminent domain, Adjudication procedure, Remedies, Judicial decisions, Legal aspects, Public rights, Access routes.

Plaintiff riparian owner sought to prohibit the construction of a pier by defendant state in the waters of a lake. Plaintiff alleged that such construction would interfere with his riparian right to ingress and egress, which right he claimed was paramount to defendant's power and duty over navigation. Plaintiff also contended that the proposed structure was not in aid of navigation since its main aspect dealt with land vehicles. The Supreme Court of Iowa, in affirming the trial court's decision for defendant, ruled that land vehicles are closely related to navigation in that materials to be transported by navigation are delivered to the ports by such vehicles. Secondly, the court ruled that a riparian owner's right to ingress and egress is subordinate to both the state and federal governments' interest in navigation. (Barker-Florida)
W71-01149

PERE MARQUETTE RY V SIEGLE (LIABILITY FOR INTERFERENCE WITH ICE BUSINESS BY DAM OPERATION).
260 Mich 89, 244 NW 239-240 (1932).

Descriptors: *Michigan, *Ice, *Dams, *Relative rights, Contracts, Land tenure, Damsites, Ponds, Ponding, Dam design, Operations, Regulation, Surface waters, Remedies, Judicial decisions, Legal aspects, Adjudication procedure, Riparian rights, Riparian land, Ownership of beds.

Plaintiff railway company brought an action to prohibit defendant from operating a dam so as to interfere with plaintiff's right to harvest ice on a pond. Plaintiff had acquired a lease, with the knowledge and consent of defendant's predecessor, to a portion of the pond where an ice business had been operated by plaintiff's lessor. When defendant bought the property on which the dam was located, it operated the dam so as to prevent ice from forming in sufficient quantity to support plaintiff's operations. The Supreme Court of Michigan ruled that plaintiff did not have the right to have the dam operated solely for his benefit, but did have the right to have the dam owners manipulate the dam reasonably so as not to interfere with the formation or harvesting of ice. The trial court's judgment for defendant was reversed. (Barker-Florida)
W71-01150

ZAMANI V OTTER TAIL POWER CO (STATUTE OF LIMITATIONS FOR FLOOD DAMAGE ACTIONS).
234 NW 457-459 (Minn 1931).

Descriptors: *Minnesota, *Flooding, *Dams, *Remedies, Legislation, Damages, Backwater, Floodwater, Adjudication procedure, Legal aspects, Judicial decisions, Land, Real property, Obstruction to flow, Flood damage, Electric power, Powerplants, Structures, Mill dams.

Defendant power company erected a dam which flooded plaintiff's property. Three years later, plaintiff sought permanent damages which resulted from such flooding. Defendant contended that its dam was for milling or manufacuring purposes, and therefore plaintiff's action was prevented by the two year statute of limitations barring action for damages caused by erection of such dams. The Supreme Court of Minnesota, in reversing a judgment for plaintiff, held that defendant's dam was of the type contemplated by the statute. The court noted, however, that a suit to abate the flooding was not barred and that plaintiff could force defendant to abate the flooding or condemn flowage rights on plaintiff's property. (Dye-Florida)
W71-01153

PAHL V LONG MEADOW GUN CLUB (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD).
233 NW 836-838 (Minn 1930).

Descriptors: *Minnesota, *Easements, *Flooding, *Backwater, Floodwater, Dams, Legal aspects, Judicial decisions, Recreation, Obstruction to flow, Damages, Leases, Flow, Flood damage, Bodies of water, Lakes, Land, Real property, Land tenure, Land use, Drainage, Leases.

Defendant gun club maintained a shooting station across a lake from its clubhouse. The water in the lake was too shallow to allow passage of rowboats to the shooting station. To deepen the lake, defendant erected a dam across the lake's outlet. This dam existed for 40 years before plaintiffs brought an action for damages caused by the flowing of their land. Plaintiffs contended that defendant's flooding of the land was a nuisance, which prevented defendant from acquiring a precriptive right to flow the property, and that defendant's occupation of plaintiffs' land was permissive as it was pursuant to a lease granted by plaintiffs to defendant to hunt and fish. The Supreme Court of Minnesota affirmed a lower court's judgment for defendant. The facts did not indicate that the flowing of plaintiffs' land was a nuisance. Flooding rights may be acquired by prescription. The lease gave defendant only the right to hunt and fish, and consequently all other uses of plaintiffs' property were of a hostile nature, capable of establishing a prescriptive right. (Dye-Florida)
W71-01155

SMITH V GEORGIA POWER CO (LIABILITY FOR FLOODING OF FARM BY OVERFLOW OF DAM).
173 SE 297-299 (SC 1934).

Descriptors: *South Carolina, *Dams, *Crops, *Flooding, Damages, Overflow, Floodgates, Rivers, Compensation, Farms, Agriculture, Flood damage, Saturation, Soaking, Submergence, Water spreading, Rainfall, Impact (Rainfall), Rain, Rainfall-runoff relationships, River forecasting, Legal aspects, Judicial decisions, Water injury.

Plaintiff farm owner sued defendant power company for crop injury from the flooding of his property caused by the opening of the floodgates of defendant's dam. Unprecedented rainfall caused water to overflow defendant's dam. Despite the opening of the floodgates, water continued to overflow the dam, and the water level continued to rise. Defendant contended that under the circumstances, opening the floodgates did not cause plaintiff's injury. Sustaining this contention, the court held that the jury's verdict for plaintiff was unsupported by the evidence and reversed the lower court's decision for plaintiff. (Hart-Florida)
W71-01158

COMMONWEALTH V CITY OF NEWPORT NEWS (LEGISLATIVE POWER TO AUTHORIZE DISCHARGE OF SEWAGE).
164 SE 689-700 (Va 1932).

Descriptors: *Virginia, *Tidal waters, *Public rights, *Sewage disposal, Fish management, Legal aspects, Water rights, Judicial decisions, Water policy, Water utilization, Water pollution, Water allocation (Policy), Water resources development, Water pollution control, Pollution abatement, State governments, Regulation, Oysters, Shellfish, Fishing, Fish conservation, Legislation.

Pursuant to a Virginia statute, defendant city discharged untreated sewage into a river. Defendant's actions polluted the tidal waters which were used for planting oysters and other shellfish. Plaintiff state brought action to enjoin defendant's actions. Plaintiff contended that the state held the waters in trust for the people who had a right of fishery. Therefore, the Virginia legislature had no authority to impair the use of the waters by the people for fishery. The Supreme Court of Appeals of Virginia affirmed the lower court's dismissal of plaintiff's action. The court held that defendant was authorized to discharge untreated sewage into the river. The court reasoned that the constitutional provision that natural oyster beds should be held in trust for the benefit of the people did not restrict the legislature's power to authorize use of tidal waters for public purposes. Furthermore, the use of tidal waters for discharge of sewage was a public use. (Powell-Florida)
W71-01165

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME I. CHAPTERS I THROUGH III.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01178

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME II. CHAPTERS IV THROUGH XI.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01179

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME III. APPENDICES I THROUGH IV.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01180

DOVER V GEORGIA POWER CO (LIABILITY FOR NEGLIGENCE IN MAINTAINING DAM).

168 SE 117-119 (Ga 1933).

Descriptors: *Georgia, *Dams, *Dam failure, *Flood damage, Dam construction, Damages, Cracking, Gates, Water control, Flow control, Concrete dams, Engineering structures, Judicial decision, Legal aspects, Water injury, Adjudication procedure.

Plaintiff owned a warehouse and property located below the dam of defendant power company. Plaintiff brought an action to recover for flood damage to his cotton seed and other property caused when the dam broke. Plaintiff introduced evidence that a small break had occurred three years before defendant purchased the dam. Defendant had no knowledge of this break and had made no material changes in the dam since its purchase. Conflicting evidence was introduced as to whether the gates in the dam were open or closed prior to the large break. The court reversed the trial court's judgment of nonsuit against plaintiff, holding that negligence in maintaining the dam was a jury question. The court stated that defendant could not be held responsible for defective construction unless it had notice of the defects, if any. (Powell-Florida)
W71-01181

LITTLE V MARTIN FURNITURE CO (LIABILITY FOR CONTRIBUTING TO THE POLLUTION OF A STREAM).
200 NC 731, 158 SE 490-491 (1931).

Descriptors: *North Carolina, *Pollutant identification, *Septic tanks, *Water pollution, Pollutants, Legal aspects, Wastes, Abatement, Water pollution control, Riparian rights, Judicial decisions, Streamflow, Domestic wastes, Sewage disposal, Sewage bacteria, Waste treatment, Sanitary engineering, Adjudication procedure, Remedies, Damages, Waste disposal, Overflow.

Plaintiff riparian landowner brought an action for damages against defendant furniture company based on defendant's alleged negligence in allowing its septic tanks to overflow. Plaintiff contended that defendant's careless maintenance of its septic tanks polluted the stream which ran through his property and thus damaged plaintiff's use of the stream water for domestic purposes. Defendant contended that it was not the primary or the sole source of the pollution. The Supreme Court of North Carolina held that even though defendant was not the sole source of the pollution, it was still liable for damages to plaintiff proximately caused by the overflow of its septic tanks. (Quesada-Florida)
W71-01182

MOORE V CHESAPEAKE AND O RY (CONSTRUCTION OF GRANTS OF WATER).
167 SE 351-366 (Va 1933).

Descriptors: *Virginia, *Grants, *Water rights, *Water supply, Contracts, Judicial decisions, Legal aspects, Water allocation (Policy), Water delivery, Water requirements, Canals, Mills, Reasonable use, Relative rights, Competing uses, Water utilization, Water demand, Water distribution (Applied).

Predecessors in title of defendant canal owner granted water rights to plaintiff mill owner. The grant obligated defendant to furnish plaintiff with a specific quantity of water in inches. Plaintiff for many years received sufficient but uncalculated amounts of water. When his water supply diminished, plaintiff halted mill operations and brought an action for specific performance. Plaintiff alleged that the water grant in terms of inches was indefinite and that the grant was therefore to be construed in light of past practices. Defendant contended that plaintiff had at all times received all the water to which he was entitled. The Supreme Court of Appeals of Virginia reversed the trial court's judgment for defendant. The court held the grant was specifically enforceable where the terms, though originally indefinite, were made definite by the parties' practical construction. The court reasoned that the grant of water, measured in inches, was intended to provide sufficient water to operate plaintiff's mill. (Powell-Florida)
W71-01184

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME II.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-188 062, $3.00 in paper copy, $0.95 in microfiche. Final Report, South Dakota State Univ., Agricultural Experiment Station, April 30, 1969. 346 p.
Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Terrain, Disposal, Patents, Costs, Reclamation, Control, Intensity, Statistical data, Deserts, Abundance, Classification, Identification, Management planning, Feasibility studies, United States Government, Homestead Acts.

Contents: Operation of the existing system of agricultural entry and use of the Federal public lands; Effects of the existing system; Potential effects of additional agricultural output from public lands; Analysis of the existing system and some goals, issues and alternatives. (See also W71-01184)
W71-01185

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME III. WORKING PAPERS: FEDERAL PUBLIC LANDS: THEIR DISPOSAL AND PERMITTED USE, 1934-67,
Public Land Law Review Commission, Washington, D.C.
Max Meyers, and William Folkerts.
Available from NTIS as PB-188 063, $3.00 in paper copy, $0.95 in microfiche. Agricultural Experiment Station, South Dakota State Univ., October 1969. 335 p.
Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Terrain, Disposal, Patents, Costs, Reclamation, Control, Intensity, Statistical data, Deserts, Abundance, Classification, Identification, Management planning, Feasibility studies, United States Government, Homestead Acts.

The three working papers treat the related subject of disposal and use of federal public lands for intensive agriculture. The first paper reports on land disposals in the 17 Western States with primary attention on those during 1934-1966. The second paper summarizes studies of selected cases particularly the administrative procedures and the actual experiences involved. The third paper describes the permitted use in private operators of lands retained in public ownership. (See also W71-01184)
W71-01186

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME IV: WORKING PAPERS FEDERAL PUBLIC LANDS: ECONOMICS OF FARM SIZE IN WESTERN UNITED STATES.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-188 064, $3.00 in paper copy, $0.95 in microfiche. Agricultural Experiment Station, South Dakota State Univ., October 1969. Various pagings.
Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Terrain, Disposal, Patents, Costs, Reclamation, Control, Intensity, Statistical data, Deserts, Abundance, Classification, Identification, Management planning, Feasibility studies, United States Government, Homestead Acts.

Contents: What is an adequate income for a farm family; The theory; Some simple examples of the effect of output on costs and returns; The homestead in the midwest--is it still adequate; Economics of size of irrigated frams; Economics of size of dryland farms. (See also W71-01184)
W71-01187

GARMANY V SOUTHERN RY (LIABILITY FOR DISCHARGE OF ACCUMULATED SURFACE WATERS).

149 SE 765-776 (SC 1929).

Descriptors: *South Carolina, *Discharge (Water), *Surface drainage, *Relative rights, Diversion, Obstruction to flow, Surface runoff, Drainage, Damages, Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Alteration of flow, Surface waters, Land, Real property, Drainage water, Railroads, Ditches, Flow, Overland flow, Overlying proprietor.

Defendant railroad held a right-of-way upland from plaintiffs' property, and water accumulated thereon. Defendant cut a ditch through a bank which held water on its land, thereby causing the water to flow onto plaintiffs' land. Plaintiffs sough

damages for injury caused by such discharge of the water. Defendant contended that an upper proprietor may be held liable for discharging surface water onto the land of a lower proprietor only where he collects the water and discharges it in a concentrated flow. Defendant contended that there was no evidence that it impounded water and concentrated its discharge onto plaintiffs' property. The Supreme Court of South Carolina affirmed the trial court's judgment for plaintiff, holding that there was ample evidence to suggest impoundment and concentrated discharge of water by defendant. A dissenting opinion emphasized the right of an upland owner to dispose of temporarily accumulated surface water as a common enemy without incurring liability to lower proprietors. (Dye-Fla)
W71-01209

MONROE CARP POND CO V RIVER RAISIN PAPER CO (RIPARIAN PROPRIETOR'S RIGHT TO USE STREAM NOT ABSOLUTE).
240 Mich 279, 215 NW 325-328 (1927).

Descriptors: *Michigan, *Riparian rights, *Reasonable use, *Water pollution, Wastes, Legal aspects, Water pollution effects, Judicial decisions, Rivers, Competing uses, Industrial water, Natural use, Relative rights, Riparian land, Riparian waters, Waste disposal, Water utilization, Carp, Fish.

Defendant paper company discharged wastes from its manufacturing plants into a river. Plaintiff, who operated a carp pond near the river below defendant's mills, obtained water for the pond from the river and used the river to transport fish from the pond to a nearby town, brought an action to enjoin defendant's pollution of the river and to obtain damages for the loss of carp. Plaintiff alleged that the wastes affected the oxygen content of the water, thereby causing the death of its fish in the pond and while in transport. Defendant claimed that, as a riparian, its use of the stream was reasonable. The Michigan Supreme Court held that defendant's use of the stream was unreasonable. A riparian proprietor's right to use water in a stream is not absolute. It is a natural right, qualified and limited by existence of a like right on the part of others. (Powell-Florida)
W71-01231

OHIO STOCK FOOD CO V GINTLING (STREAM POLLUTION BY UPPER RIPARIAN HOG FARM).
153 NE 341-345 (Ohio Ct App 1926).

Descriptors: *Ohio, *Municipal wastes, *Garbage dumps, *Pollution abatement, Water pollution, Wates disposal, Legal aspects, Judicial decisions, Streams, Hogs, Riparian water, Riparian land, Riparian rights, Farms, Farm wastes.

Defendant corporation owned a farm one mile from plaintiff's farm. Defendant, under contract with a municipality, received the city's garbage and disposed of it by feeding it to hogs. A stream flowed through defendant's property, then passed through plaintiff's land. Plaintiff brought a nuisance action for damages, alleging that during the operation of its farm, defendant polluted the stream through drainage of liquid, filth and refuse. Defendant contended that its acts in the operation of its farm were authorized by law, inasmuch as it had a contract with a municipality to dispose of the garbage. The Ohio Court of Appeals held that plaintiff was liable for damages, notwithstanding the municipal contract. An upper proprietor of land cannot by artificial means pollute a stream to the injury of a lower riparian owner. (Powell-Florida)
W71-01237

ASHLEY V HOLDBERT (LANDOWNER'S LIABILITY FOR ROCKSLIDE DAMAGE CAUSED BY FAILURE TO MAINTAIN CLEAR CHANNEL FOR NATURAL DRAINAGE).
148 Misc 45, 265 NYS 138-141 (1933).

Descriptors: *New York, *Drainage water, *Drainage effects, *Rockslides, Damages, Riddance (Legal aspects), Drainage, Surface runoff, Land management, Topography, Landslides, Remedies, Legal aspects, Judicial decisions, Soil stabilization, Earth materials.

Plaintiff landowner brought action to recover damages caused when a large quantity of stone and soil, from defendant landowner's upper tract, was washed down the natural slope onto plaintiff's lower tract. Plaintiff contended that defendant had placed the rock and soil in the path of the natural flow of rain water and that the draining rain water had carried the materials onto plaintiff's land. Defendant contended that he did not place the stone and soil in the path of the natural drainage and that the rockslide resulted solely from the natural flow of the rain water. The court held that while an upper landowner is not liable for damage caused by rainwater carrying rock or soil from his land onto lower tracts, he is liable if he places soil or rock where natural drainage will carry it to lower tracts. He is also liable if he fails to provide a clear channel for the natural drainage of water from his upper tract. Proof was adequate to support a finding for plaintiff. (Quesada-Florida)
W71-01249

NOBLE V ECHO LAKE TAVERN, INC (RIGHT TO DRAW WATER AND TITLE TO LAKE BED: DEED INTERPRETATION).
142 Misc 427, 254 NYS 662-667 (1931).

Descriptors: *New York, *Lakes, *Ownership of beds, *Domestic water, Reasonable use, Boundaries (Property), Non-navigable waters, Riparian rights, Riparian land, Legal aspects, Judicial decisions, Remedies, Water consumption, Beneficial use, Easements, Water utilization, Recreation, Prescriptive rights, Land tenure.

Plaintiff riparian landowner sought an injunction to prevent defendant corporate landowner from taking lake water for other than domestic uses. Plaintiff also sought to have a declaration of his title rights to the bed of the lake. Plaintiff contended that in the deed from himself to defendant's vendor, which conveyed two tracts separated from the lake, he gave only the right to draw water for domestic purposes. Moreover, plaintiff contended, he had conveyed title to only so much of the lake bed as was necessary to lay pipelines for that purpose. Defendant contended that the deed's language, 'and far enough into said pond to furnish water,' gave title to a large part of the bed, the right to draw water for all purposes, and an easement of access to the water. Defendant further claimed: (1) title to the used portion of the bed by adverse possession, and (2) a prescriptive right to the quantity of water it had been drawing. The court held that (1) the deed conveyed only so much of the bed as was necessary to draw water for domestic use, and (2) the words contained in the deed were insufficient color of title upon which to base adverse possession. (Quesada-Florida)
W71-01269

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (EVIDENCE OF HIGH WATER MARK AND TITLE TO BEDS).
231 App Div 398, 247 NYS 756-760 (1931).

Descriptors: *New York, *Boundaries (Property), *Ownership of beds, *River beds, High water mark, Watercourses (Legal), Water level fluctuations, Streamflow, Riparian land, Riparian waters, Banks, Islands, Channels, Vegetation, Legal aspects, Judicial decisions, Remedies, Boundary disputes, Adjudication procedures.

Plaintiff owned land on one side of a certain river. This action was brought to establish title to two pieces of land, one on the opposite bank of the river and the other a part of an island in the river. Defendant hydroelectric company contended that plaintiff's title ran only to the center of the river and not all the way across to the opposite bank. Defendant also claimed that the part of the island in question was above the high water mark, and thus not within the area originally deeded to plaintiff. The New York Supreme Court, Appellate Division, affirmed a lower court decision for defendant. The court found ancient documents were convincing in showing the boundary of plaintiff's property to extend only to the middle of the river. The evidence also established the existence of an abundance of vegetation indicative that the part of the island in question was above the high water, and thus not owned by plaintiff. (Morris-Florida)
W71-01278

BULL V STATE (LOWER PROPRIETOR NOT LIABLE FOR GRADE CHANGES WHICH REPULSE SURFACE WATER).
231 App Div 313, 247 NYS 183-185 (1931).

Descriptors: *Repulsion (Legal aspects), *New York, *Surface waters, *Flood damage, Flooding, Floodwaters, Slopes, Artificial watercourses, Watercourses (Legal), Water control, Grading, State Governments, Highways, Surface drainage, Surface runoff, Remedies, Damages, Legal aspects, Judicial decisions, Surface waters, Relative rights.

Plaintiff landowner sued defendant state for damages caused to his land by flooding after the state constructed a highway and sluiceway. Plaintiff claimed improper construction prevented the natural drainage from carrying waters from a watershed and caused water to back up on his land. Defendant contended that it had a duty to construct and maintain the road, but that it owed no duty to adjacent landowners to allow their surface water to drain onto the highway. The New York Supreme Court, Appellate Division, reversed a lower court decision for plaintiff. The court said the floodwater was surface water, not carried through a natural watercourse, and an adjacent owner is not required to take care of surface waters coming onto his land from the lands of another. A lower proprietor may fill and grade his lands even though the result is to set back surface waters upon his neighbor's land. (Morris-Florida)
W71-01282

IBP DESERT RESEARCH UNDERWAY,
For primary bibliographic entry see Field 06A.
W71-01284

KELLOGG V ILLINOIS CENT RR (LIABILITY FOR OVERFLOW OF DRAINAGE DITCH).
239 NW 557-558 (Iowa 1931).

Descriptors: *Iowa, *Drainage, *Ditches, *Overflow, Drainage districts, Administrative agencies, Legal aspects, Judicial decisions, Damages, Watercourses (Legal), Bridges, Streams, Land tenure, Specifications, Crops, Excavation, Abutments, Water injury, Flood damage.

Plaintiff brought suit against defendant railroad company to recover damages to crops resulting from the overflow of a drainage ditch located under defendant's railroad bridge. The ditch was part of a drainage district established upon the petition of defendant. As part of the specifications of the district, defendant was required to raise the elevation of its bridge. Defendant complied with all the specifications called for by the engineer of the drainage district. The trial court dismissed plaintiff's complaint, and the Supreme Court of Iowa affirmed. The court held that since defendant complied with all the specifications of the improvement, plaintiff's suit was barred. (Duss-Florida)
W71-01296

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
For primary bibliographic entry see Field 06B.

W71-01300

ALMO WATER CO V JONES (RIGHT TO APPROPRIATE WATER).

39 F2d 37-40 (9th Cir 1930).

Descriptors: *Appropriation, *Prior appropriation, *Diversion, *Water rights, Relative rights, Irrigation, Watercourses (Legal), Utah, Idaho, Rivers, Streams, Water supply, Priorities, Preferences (Water rights), Legal aspects, Judicial decisions, Adjudication procedure, Water quantity.

Plaintiff land company diverted and appropriated river water to irrigate land. Defendants, residents of Idaho and Utah, also claimed the right to use the appropriated water. Plaintiff instituted suit to settle and determine its right to use the water, to quiet title thereto, and to restrain defendants from interfering therewith. The trial court awarded certain defendants some water rights. Appeal was taken by plaintiff water company and by some defendants who were dissatisfied with the lower court's decree. The circuit court affirmed. Evidence showed that plaintiffs and their predecessors in interest had validly appropriated water and had not lost their rights because of adverse use by others. The trial court's reduction of the appropriation of one of the plaintiffs was also supported by the evidence. As to those defendants appealing, it appeared that the award was not an equitable division of the amount of appropriations possessed by them. However, the court held that insurmountable jurisdictional problems prevented it from granting relief. Many claimants were not parties to the appeal, and some claimants could not be given an increase in allowance without giving all claimants an opportunity to present their case. (Duss-Florida)
W71-01302

MANHATTAN OIL CO V MOSBY (LIABILITY FOR POLLUTING STREAM BY ESCAPE OF SALT WATER FROM OIL WELL).
72 F2d 840-847 (8th Cir 1934).

Descriptors: *Saline water, *Water pollution, *Oil wells, *Saline water intrusion, Water pollution sources, Well regulations, Wells, Saline water-freshwater interfaces, Kansas, Judicial decisions, Streams, Encroachment, Fresh water, Water utilization, Impaired water quality, Pollutants, Pollutant identification, Legislation, Water pollution control, Water pollution effects, Legal aspects.

In an action for damages, plaintiff contended that defendant oil drilling company polluted a stream running through plaintiff's ranch by allowing salt water to escape from an embankment at defendant's oil well site. Plaintiff contended that such pollution impaired the water for stock purposes. Defendant contended that plaintiff had failed to allege negligence and thus was precluded from recovering. The court held that a Kansas statute imposed absolute liability upon controllers of oil wells who allow salt water to escape from an oil well site. The court ruled that the fact that the salt water had escaped was a breach of defendant's absolute duty notwithstanding a showing of negligence. Defendant was thus held liable for damages caused by the pollution of the stream. (Snow-Florida)
W71-01303

KENNILWORTH MANAGEMENT CO V CITY OF ITHACA (REFUSAL OF CITY TO SUPPLY WATER UNDER CONTRACT).
313 NYS2d 35-42 (Sup Ct 1970).

Descriptors: *New York, *Cities, *Contracts, *Water supply, Claims (Contracts), Supply contracts, Performance, Contract administration, Municipal wastes, Sewers, Urbanization, Utilities, Public utilities, Water distribution (Applied), Sewage districts, Water allocation (Policy), Water demand, Water requirements, Water resources, Judicial decisions, Legal aspects.
Identifiers: Ithaca (NY).

Plaintiff landowner sought a declaratory judgment to determine whether defendant city could refuse water and sewer service to plaintiff. Plaintiff's property was located in the town of Ithaca, as distinguished from defendant city of Ithaca. Defendant had contracted with the town to supply its residents with water and sewer service. The contract provided that defendant was not obligated to supply water if the supply for its own inhabitants would thereby become insufficient. Defendant relied upon this provision in refusing service to plaintiff. The court held that in such an instance, a municipality not only was not obligated to provide water outside the community, it had a duty not to do so. Plaintiff further asserted that defendant acted arbitrarily and was guilty of laches by permitting the town to lay water mains for plaintiff and then refusing service. The court determined that defendant had acted in good faith in refusing plaintiff service. Plaintiff finally contended that defendant breached the contract by failing to give notice of discontinuance, but the court found that this contract provision only applied to users already receiving water. The action was dismissed. (Hart-Florida)
W71-01307

CITY OF MILWAUKEE V AMERICAN SS CO (PARAMOUNT RIGHT OF THE FEDERAL GOVERNMENT OVER NAVIGATION ON NAVIGABLE WATERS).

76 F2d 343-344 (7th Cir 1935).

Descriptors: *Navigation, *Navigable waters, *Federal government, *Federal jurisdiction, Boats, Harbors, Lakes, Ships, Transportation, United States, Relative rights, Cities, Legislation, Judicial decisions, Governments, Great Lakes.

Plaintiffs, owners and operators of steam vessels engaged in interstate commerce on the Great Lakes, sought an injunction to restrain the City of Milwaukee from enforcing certain ordinances regulating vessels in the harbors of the city. Plaintiff contended that the ordinances, which required the vessels to use tugs while in Milwaukee's harbors, were void as being repugnant to the regulations of the War Department in exercise of the federal government's power over navigable waters. The defendant contended that the regulations of the War Department did not preclude the defendant from also establishing regulations. The court held that the War Department, in establishing comprehensive regulations for the operation of vessels in the navigable waters of Milwaukee harbor, had precluded the enactment of municipal regulations upon this subject. The War Department's regulations, being an exercise of the federal government's paramount right over interstate commerce, indicated that the federal government intended to preempt the area. Defendant was thus restrained from enforcing its ordinances. (Snow-Florida)
W71-01309

STATE EX REL BUCKSON V PENNSYLVANIA RR (OWNERSHIP OF FORESHORE OF NAVIGABLE RIVER).
267 A2d 455-460 (Del 1969).

Descriptors: *Delaware, *Land tenure, *Landfill, *Intertidal areas, Delaware River, Real property, Land use, High water mark, Low water mark, Railroads, State governments, Beaches, Tides, State jurisdiction, Navigable rivers, Navigable waters, Riparian rights, Legal asepcts, Judicial decisions.

Plaintiff state sought a declaratory judgment with defendant railroad company to determine the right of defendant to fill in the foreshore of the Delaware River. Defendant, a riparian owner on the Delaware River, diked and filled part of the foreshore. Defendant contended that its title extended to low water mark, and therefore included the foreshore. Plaintiff contended that defendant's title only extended to high water mark. Plaintiff further asserted that filling of the foreshore was prohibited without its permission. The court held that defendant held title to the low water mark, including the foreshore and that plaintiff's prior consent was unnecessary for defendant to fill its property. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-01313

MINNIE CREEK DRAINAGE DIST V STREETER (ANNEXATION OF LANDS TO DRAINAGE DISTRICT).
327 111 236, 158 NE 383-386 (1927).

Descriptors: *Illinois, *Drainage districts, *Benefits, *Surface drainage, Surface runoff, Surface waters, Drains, Ditches, Tile drains, Tile drainage, Construction, Discharge (Water), Diversion, Easements, Highways, Legal aspects, Judicial decisions, Watercourses (Legal), Maintenance, Land tenure, Flow, Natural flow doctrine.

Plaintiff drainage district petitioned to annex defendant's lands to its district. Plaintiff alleged that tile drains already drained defendant's land into the district, that defendant's land was benefited by this connection, and that defendant would be benefited in the future by further construction and maintenance of drainage ditches. Defendant denied the connection of her land to district drains or that she or her predecessors had made voluntary application to the district. Defendant alleged her lands were dominant to the district, were adequately drained by natural flow and that she had not diverted water onto the district. The lower court granted plaintiff's petition, and the Supreme Court of Illinois affirmed. The evidence showed that defendant's lands were drained by tile drains to the district several years prior to the petition. State law provides that landowners outside of districts who connect with them shall be deemed to have made voluntary application to be included in such districts. Dominant estates must also assume the burdens of state law when they connect to drainage ditches by artificial means. Furthermore, it is presumed when lands are so connected that they are benefited by the district. (Duss-Fla)
W71-01356

BINGHAM LAND CO V CENTRAL MAINE POWER CO (LIABILITY FOR ALTERING FLOW OF STREAM).
180 A 363 (Me 1935).

Descriptors: *Maine, *Dams, *Streamflow, *Currents (Water), Watercourses (Legal), Flow, Riparian rights, Riparian waters, Streams, Mills, Damages, Legal aspects, Judicial decisions, Alteration of flow, Impounded waters, Impoundments.

Plaintiff upper riparian owner sought damages from defendant lower riparian owner. Defendant had constructed a dam which changed the flow of a stream, which ran through plaintiff's land, from a swift current to pond water. Plaintiff sought damages for destruction by the dam of possible water power development. The commissioners excluded evidence of such damage on the ground that any such loss was not compensable as a violation of a legal right. The Supreme Judicial Court of Maine affirmed per curiam. (Duss-Fla)
W71-01357

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06B.
W71-01358

PERKINS V VERMONT HYDRO-ELECTRIC CORP (LIABILITY FOR FLOOD DAMAGE).

177 A 631-654 (Vt 1934).

Descriptors: *Vermont, *Flood damage, *Flood protection, *Dikes, Floods, Watercourses (Legal), Diversion, Discharge (Water), Damages, Dams, Conduits, Erosion, Rivers, Hydroelectric plants, Obstruction to flow, Maximum probable flood, Sluices, Floodgates, Rainfall, Storms, Ditches, Land tenure, Culverts, Legal aspects, Judicial decisions.

Plaintiff sought damages from defendant hydroelectric corporation for destruction of his property by floodwaters. Plaintiff alleged defendant's negligent construction of a diversion conduit and dike was a cooperative and producing cause of the flood damage. Defendant contended that the flood was of such extraordinary force that it was an act of God. The Supreme Court of Vermont reversed the trial court's judgment for plaintiff. The court ruled that there was sufficient evidence to allow submission to the jury of the question of the adequacy of defendant's construction of the diversion conduit and dike. However, the sufficiency of the dike was not a proper factor in the case since the high water mark of the flood was so much greater than the previous high water mark that any inadequacy in the height of the dike would have had no practical effect on the flood. The court held that it was reversable error for the trial court to fail to instruct the jury on defendant's lack of liability if the damage was independently produced by an act of God. (Morris-Fla)
W71-01361

GRAHAM V SAFE HARBOR WATER POWER CORP (DURATION OF FLOOD RIGHTS).
173 A 311-312 (Pa 1934).

Descriptors: *Pennsylvania, *Easements, *Flooding, *Prescriptive rights, Relative rights, Rivers, Watercourses (Legal), Land tenure, Floods, Damages, Legal aspects, Judicial decisions, Adjudication procedure, Dams.

Plaintiffs sought to recover flood damages resulting from defendant corporation's erection of a dam. The original grantor of plaintiffs' land had conveyed floodage rights to the land, and defendant acquired the rights before constructing the dam. Successive conveyances of the land down to plaintiffs contained no reference to the original grant of floodage rights. Plaintiffs alleged that the successive owners of the land had exercised acts of ownership sufficient to extinguish defendant's floodage rights. The trial court directed a verdict for defendant, and the Supreme Court of Pennsylvania affirmed. Plaintiffs' theory was that the acts of ownership constituted adverse possession extinguishing defendant's floodage rights. However, the possession pleaded and proved was not 'adverse' or 'hostile' to defendant. Neither plaintiffs nor their predecessors interfered with the easement conveyed by the original grantor. In some jurisdictions failure to use an easement for a specified length of time will terminate it, but such is not the rule in Pennsylvania. Finally, plaintiffs' contention that defendant's floodage rights were restricted to a small part of the land was a strained interpretation of the original grantor's conveyance. (Duss-Fla)
W71-01362

SPECIAL CASES OF WATER SUPPLY INTERFERENCE CAUSED BY URBAN DEVELOPMENT NEAR TORONTO, ONTARIO, CANADA,
Ontario Water Resources Commission, Toronto.
For primary bibliographic entry see Field 02F.
W71-01363

SUMMARY, FEDERAL AGENCY TECHNICAL COMMENTS ON THE SPECIAL TASK FORCE REPORT ENTITLED 'PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS.'
Water Resource Council, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01370

VERMONT SHADE ROLLER CO V BURLINGTON TRACTION CO (INTERPRETATION OF WATER RIGHTS UNDER CONTRACT).

150 A 138-147 (Vt 1930).

Descriptors: *Vermont, *Water contracts, *Water control, *Water measurement, Contract administration, Water rights, Discharge (Water), Legal aspects, Judicial decisions, Riparian rights, Riparian land, Riparian waters, Water wheels, Bulkheads, Obstruction to flow, Water levels, Water users, Tailrace, Water demand, Relative rights, Mills, Power operation and maintenance, Weirs.

Plaintiff company and defendant company owned water power rights in a river. A contract had been entered into by the parties' predecessors in 1872 which purported to define the rights of each as to the quantity of water to be utilized for power production. Plaintiff contended it was entitled to as much water as would pass through two openings, each ten inches square with rounded edges. Plaintiff also contended he was entitled to capture and use surplus and flood water in addition to his rights under the contract. Defendant contended plaintiff's rights were limited to those under the contract, and that plaintiff was entitled to that amount of water that would pass through two openings, each ten inches square with square, rather than rounded edges. The court found no facts from which it could fairly infer that rounded edges were contemplated by the parties to the agreement. The court found that square edges on the watergates were contemplated by the parties, and that plaintiff's rights were limited by the language of the contract. Plaintiff's rights were accordingly reduced, and the trial court's judgment for plaintiff reversed. (Price-Florida)
W71-01382

VILLAGE OF BRATTLEBORO V YAUVEY (JURISDICTION OF MUNICIPAL COURT TO TRY WATER RIGHTS CASE).
143 A 295-296 (Vt 1928).

Descriptors: *Vermont, *Jurisdiction, *Contracts, *Water users, Land tenure, Reservoirs, Cities, Local governments, Water demand, Water rights, Legislation, Contract administration, Water works, Legal aspects, Judicial decisions, Rent, Water supply.

Plaintiff waterworks owner sought to recover rents allegedly due from defendant for water furnished by plaintiff. Defendant claimed the right to free water based on a contract with plaintiff's predecessor in title. The lower court found for plaintiff. On appeal, defendant contended that the lower court was without jurisdiction to try the case. The Supreme Court of Vermont stated that the right to take water from a reservoir system is in itself an interest in real estate. The court then held that since the issue involved the proving of title to real estate, the municipal court was without jurisdiction. The trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-01384

BAUMAN V BARENDREGT (RIPARIAN OWNER'S RIGHT TO USE ENTIRE LAKE).
251 Mich 67, 231 NW 70-71 (1930).

Descriptors: *Michigan, *Ownership of beds, *Riparian rights, *Boundary disputes, Boundaries (Property), Relative rights, Fishing, Water utilization, Boating, Recreation, Beds under water, Riparian land, Watercourses (Legal), Lakes, Remedies, Judicial decisions, Legal aspects.

Plaintiffs, riparian owners on a lake, sought to prohibit defendant from fishing and boating on the lake. Defendant was also a riparian owner on the lake, but plaintiffs claimed that defendant's title to the riparian land gave no ownership to the ake bed and thus no right to use the water. The Supreme Court of Michigan, affirming the trials court's judgment for defendant, ruled that a grant of riparian land carries title to the center of the body of water fronting on the property and that each riparian owner has the right to fish in any part of the lake. (Barker-Florida)
W71-01412

PRESTON V CLARK (UPPER RIPARIAN OWNER'S RIGHT TO MAINTAIN DAM).
238 Mich 632, 214 NW 226-229 (1927).

Descriptors: *Michigan, *Riparian rights, *Prescriptive rights, *Natural flow doctrine, Damsites, Relative rights, Dams, Obstruction to flow, Lakes, Streams, Mills, Surface waters, Water utilization, Dam construction, Flow control, Water control, Water supply, Water levels, Judicial decisions, Legal aspects.

Plaintiff mill owners sought to prohibit defendant upper riparian owner from maintaining a dam on a stream which supplied the power for plaintiffs' mills. Plaintiffs contended that they had acquired a prescriptive right to continued flow of the water at its natural volume. They had depended upon such flow for fifty years, and the dam now severely curtailed the water volume. Defendant argued that plaintiffs were not injured by the dam's existence and claimed the right to maintain the same through his riparian ownership. The Supreme Court of Michigan, affirming the trial decision for defendant, ruled that an upper riparian owner may erect such a dam and, as long as the lower owners are not substantially injured hereby, lower proprietors have no grounds for challenging such an exercise of riparian rights. (Barker-Florida)
W71-01413

JOHNSON V CITY OF FAIRMONT (JOINT LIABILITY OF INDEPENDENT POLLUTERS).
247 NW 572-573 (Minn 1933).

Descriptors: *Minnesota, *Water pollution sources, *Remedies, *Adjudication procedure, Path of pollutants, Water pollution, Pollutants, Effluents, Sewage, Cities, Pollutant identification, Streams, Water pollution effects, Odor, Sewage effluents, Wastes, Industrial wastes, Farms, Septic tanks, Waste disposal, Damages, Judicial decisions, Legal aspects.
Identifiers: Fairmont (Minn).

Plaintiff farmer sued defendant city and defendant canning company for damages resulting from each defendant's discharge of pollutants into a stream flowing through plaintiff's land. The sole question on appeal was whether the two defendants could be jointly liable even though their actions were independent. The Supreme Court of Minnesota ruled that where both defendants acted separately and independently of the other, they could not be held jointly liable for damages cuased by their acts. The court rejected plaintiff's theory that an implied concert of action arose from each defendant's knowledge of the other's acts. (Barker-Florida)
W71-01414

CITY OF CINCINNATI V KIRK (CITY'S LIABILITY FOR POLLUTION FROM SEWAGE SYSTEM).

20 Ohio App 452, 152 NE 207-208 (1925).

Descriptors: *Ohio, *Water pollution sources, *Damages, *Water pollution effects, Cities, Riparian rights, Streams, Effluents, Sewage, Sewage effluents, Water pollution, Impaired water quality, Pollutants, Judicial decisions, Legal aspects.
Identifiers: Cincinnati (Ohio).

Plaintiff landowners sued the City of Cincinnati for damages caused to a stream which ran through plaintiffs' land. Defendant city had constructed a sewage system which emptied into the stream and thus rendered the stream valueless to the riparian owners. The trial jury, based on damages covering

a five year period, returned an award against defendant city. The appellate court found that full ownership of the property was not in plaintiffs for the entire period and ordered a remittitur of part of the award. The lower court's judgment was affirmed on the question of liability. (Barker-Florida)
W71-01415

TICHENOR V WITHERSPOON (LIABILITY FOR DISCHARGE OF POLLUTANTS INTO STREAM).

158 NE 514-516 (Ind Ct App 1927).

Descriptors: *Indiana, *Water pollution, *Saline water, *Alteration of flow, Pollutants, Water pollution effects, Damages, Path of pollutants, Oil wells, Water pollution sources, Oil industry, Streams, Discharge (Water), Riparian rights, Pumping, Judicial decisions, Legal aspects, Overflow, Water injury, Overlying proprietor.

Plaintiff landowner sought damages from defendant for injury to his land resulting from the discharge of large amounts of accumulated salt water and other pollutants into a stream which flowed through plaintiff's land. Defendant operated an oil well on his property and discharged the salt water into a natural watercourse, but claimed that he acted reasonably and with ordinary care to prevent such damage. Plaintiff claimed that the water became polluted, and when the stream overflowed its banks because of the great volume of discharge, his land was made untillable. The court ruled that if an upper landowner alters the natural conditions of a watercourse so as to change the course of water, or concentrates it at a particular point, or by artificial means increases its volume, he becomes liable for any injury caused thereby. The trial court's decision for plaintiff was affirmed. (Barker-Florida)
W71-01416

MARBA SEA BAY CORP V CLINTON ST REALTY CORP (AVULSION OF BEACH FRONT PROPERTY).
284 (NYS 59-61 (1935).

Descriptors: *New York, *Avulsion, *Beach erosion, *Storms, Beaches, Judicial decisions, Legal aspects, High water mark, Low water mark, Adjudication procedure, Real property, Precipitation excess.

In a per curiam decision in a land partition case, the court held that plaintiff failed to sustain the burden of proving loss of land by avulsion since the testimony offered consisted of approximations and guesses as to the amount of land carried away by several storms and the location of the shoreline in question immediately prior to any one of the storms. Such uncertainty could not support a verdict for plaintiff. (Clark-Florida)
W71-01417

BAYORK REALTY CORP V STATE (OWNERSHIP OF ACCRETION).
251 App Div 534, 297 NYS 973-78 (1937).

Descriptors: *New York, *Riparian rights, *Accretion (Legal aspects), *Islands, Boundaries (Property), Boundary disputes, Community development, Judicial decisions, Land tenure, Legal aspects, Proprietary power, Relative rights, Riparian land, Riparian waters, State governments, Currents (Water).

Defendant state appropriated the island in question from a real estate corporation in 1934, based on a map drawn in 1913. During the interim, accretions enlarged the island by 4.07 acres. The corporation subsequently sold this excess acreage to plaintiff. The question was whether defendant owned the whole island or merely that part described in the 1913 map. The court held that slow and imperceptible accretions belong to the riparian owner of the land to which such accretion attaches. Prior to the corporation's conveyance to plaintiff, it had proferred to defendant a confirmatory deed which recited that such deed vonveyed all the corporation's real property located on the island. Based on this statement, the court held that defendant owned the whole island. (Clarke-Florida)
W71-01418

SHAPLEIGH V UNITED FARMS CO (BOUNDARY DISPUTE RESULTING FROM AVULSIVE CHANGE IN RIVER CHANNEL).
100 F2d 287-89 (5th Cir 1938).

Descriptors: *Texas, *Avulsion, *Boundary disputes, *Boundaries (Property), Navigable waters, Accretion (Legal aspects), Rio Grande, Channel morphology, Land forming, Legislation, Patents, Meanders, Watercourses (Legal), Judicial decisions, Legal aspects, Real property.

In a consolidated suit in trespass to try title to realty, plaintiff landowners claimed certain lands which they contended were cut by avulsive changes in the river channel from a tract of land given them by the President of Mexico. Defendant landowner claimed title to the lands through a chain of title beginning with patents from the State of Texas. The lands were located at the time of the contest within defendant's boundaries as described in his muniments of title. The court stated that the presumption is in favor of present boundaries, and he who asserts that the channel of a watercourse recognized as the boundary line is not, in fact, at the point in controversy, the true boundary, resting his contention upon a sudden shifting of the course of the channel, assumes the burden of proving that fact. The court held that plaintiffs had failed in their proof, and the judgment for defendant was affirmed. (Price-Florida)
W71-01419

WITTMAYER V UNITED STATES (EXCEPTIONS TO THE RULE THAT TITLE TO LAND BOUNDED BY A RIVER GOES TO THE SHORE).
118 F2d 808-11 (9th Cir 1941).

Descriptors: *Montana, *Boundaries (Property), *Boundary disputes, *Eminent domain, Meanders, Accretion (Legal aspects), Condemnation, Dams, Reservoirs, Navigable rivers, Navigable waters, Judicial decisions, Legal aspects, Legislation, Patents, Missouri River, River flow, Low water mark, High water mark, Islands, Floodwaters, Vegetation.

Plaintiff United States instituted suit against defendant landowners to acquire by condemnation lands on an island in the Missouri River for construction of a dam and reservoir project. Defendants contended they should be compensated for the land conveyed to them by patent as well as the land accreted thereto. Plaintiff contended the accreted lands were part of the public domain. Some of the accreted land between the meander line and the river was in existence prior to defendants' homestead entry. The court stated that the boundary of a grant such as defendants' is usually the actual water line and not the meander line. Two exceptions exist, however. Where by reason of fraud or mistake in the survey, there is at the time of the survey a substantial amount of land between the survey line and the actual shore, the meander line is treated as the true boundary. This is true also if between the time of survey and the time of entry, a substantial amount of land was formed between the survey line and the water. The trial court's decision that defendants' boundary was the meander line and that the land in question was public domain was affirmed. (Price-Florida)
W71-01420

ISELIN V LA COSTE (OWNERSHIP OF ISLANDS IN NAVIGABLE WATERS).
139 F2d 887-888 (5th Cir 1944).

Descriptors: *Mississippi, *Boundary disputes, *Riparian rights, *Avulsion, Meanders, Boundaries (Property), Federal jurisdiction, Judicial decisions, Legal aspects, Natural flow doctrine, Ownership of beds, Relative rights, Riparian land, Riparian waters, Usufructuary right, Watercourses (Legal), Rivers, Mississippi River, Currents (Water), Accretion (Legal aspects), Channels, Streamflow.

Plaintiff owned land in Louisiana adjacent to the Mississippi River. Due to natural fluctuations in the course of the river channel, part of plaintiff's land became submerged, then reappeared later as an island located on the opposite side of the thread of the channel from plaintiff's land. Plaintiff sought to quiet title to the island. The court stated that under Mississippi law, a riparian proprietor owned to the thread of the stream. Furthermore, when a river forms the boundary between two states, and natural physical changes cause the channel to shift, the new channel becomes the boundary. Where an avulsion occurs because of a flood or freshet, however, causing a sudden change in the course of the stream, the center of the old channel remains the boundary. The facts of this case clearly indicated the former situation and the court affirmed the trial court's judgment for defendant. (Clarke-Florida)
W71-01421

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (EXCESSIVE WITHDRAWAL OF WATER FROM RIVER).
166 Misc 10, 1 NYS2d 915-17 (1938).

Descriptors: *New York, *Usufructuary right, *Administrative agencies, *Diversion, Competing uses, Reasonable use, Relative rights, Judicial decisions, Legal aspects, Regulation, Ownership of beds, State governments, Riparian rights, Navigable rivers, Public rights, Patents, Natural flow, Easements, Riparian land, Water rights, Water users.

Plaintiff water commission brought action to enjoin defendant's excessive withdrawal of water from the Niagara River and to determine ownership in the bed and waters of said river. Defendant was a riparian landowner on the Niagara River who claimed the right to divert and utilize the flow of the water by reason of its riparian rights as owner of the banks of the river. Plaintiff alleged that the state was the sovereign and proprietary owner of the bed and waters of the river, and that state statutes giving perpetual grants to defendant of such river's riparian land waters was unconstitutional. The court found that the right of the owner of riparian land to the natural flow of water in a stream adjacent to the land is a corporeal herditament. Such hereditament is more than an easement; it is a usufructuary right. It is properly classified at common law, equally with the land itself, as real property. The right to the use of the water of a flowing stream, navigable or non-navigable, arises by mere operation of law as incident to the ownership of the bank and is part of the estate of its owner to which plaintiff could not object. (Barnett-Florida)
W71-01422

GUCKER V TOWN OF HUNTINGTON (DETERMINATION OF RIGHTS TO SAND BAR IN NAVIGABLE WATERS).
254 App Div 10, 3 NYS2d 788-93 (1938).

Descriptors: *New York, *Cities, *Sand bars, *Accretion (Legal aspects), Navigable waters, Boundaries (Property), Real property, Riparian rights, Landfills, Overlying proprietor, Bays, High water mark, Tidal waters, Dredging, Boats, Riparian land, Ownership of beds.
Identifiers: Huntington (NY).

Plaintiffs brought suit to cancel, as a cloud on title, three quitclaim deeds purporting to release rights in a certain sand bar situated in tidal waters. Plaintiffs also sought relief for the alleged invasion of their riparian rights by defendant city's dredging

and deposit of material on the sand bar which raised its level and made it impassable for small boats. The lower court held for plaintiffs, directing the restoration of the status quo of the sand bar and restoration of other property which the court found defendant to have dealt with unjustly in violation of plaintiffs' rights. The appellate court modified and reversed the lower court's holding, stating that the sand bar was not contiguous to plaintiffs' upland and thus title did not reside in them as the owners of accreted lands adjacent or contiguous to their riparian upland. Title to land under navigable waters, subject to the rights of the public and upland owners was found to reside in the state to the high water mark and not in plaintiffs. In light of such ownership, the court held that defendant had not dealt unjustly with plaintiffs' lands. (Barnett-Florida)
W71-01423

BROWN V STATE (CANAL CONSTRUCTION AS A CONTRIBUTORY CAUSE OF FLOODING).

30 NYS2d 671-72 (1941).

Descriptors: *New York, *Flood damage, *Canal construction, *Rainfall, Damages, Flooding, Floods, Cloudbursts, Floodwater, Rain, Rain water, Canals, Judicial decisions, Locks, Excessive precipitation, Rainfall intensity, Legal aspects, Operation and maintenance.

In an action for damages, plaintiff contended that defendant state was liable for damages for the flooding of his lands along a river between certain state barge canal locks. Plaintiff contended that the barge canal was improperly constructed or negligently maintained so as to maximize the effects of a flood caused by an exceptionally great rainfall. Defendant contended that the sole cause of the flooding was the concentration of rainfall. The court held that testimony supported the finding that the canalization of the river, construction of dams and reservoirs, and deepening, widening and straightening of the river actually lessened the damage from the flooding. Thus, since the barge canal construction was not a contributing cause of the flooding, plaintiff was denied recovery. (Snow-Florida)
W71-01424

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (RIPARIAN RIGHT TO DIVERT THE WATERS OF A NAVIGABLE RIVER).
262 App Div 460, 30 NYS2d 371-78 (1941).

Descriptors: *New York, *Riparian rights, *Diversion, *Water utilization, Riparian land, Riparian waters, Navigable waters, Legislation, Judicial decisions, Relative rights, Severance, Rivers, Navigable rivers, Public rights, Use rates, Administrative agencies, State governments, Usufructuary right, Regulation, Supervisory control (Power).

Plaintiff, a state agency, brought an action for a declaratory judgment to determine if it could require defendant power company to pay a rental for the use of the waters of the Niagara River. Plaintiff contended that the state's conservation law authorized it to collect rental for diversion of the waters of a public navigable river. Defendant contended that the act did not apply to it in that it had a pre-existing right to divert and use the waters of the river. Defendant contended that such right was a common law right of diversion as a riparian owner. The court held that the defendant, as a riparian owner, had the right to divert and use the waters of the river and that such right was subject only to the paramount right of the state to utilize the waters for a public use. The court held that the legislature had not delegated to plaintiff the authority to exercise the state's paramount right and thus defendant's right as a riparian was unaffected. The existence of such pre-existing right precluded the operation of the statute, and thus no rental could be charged. (Snow-Florida)
W71-01425

PEOPLE V STATE TAX COMM'N (VALIDITY OF FRANCHISE ASSESSMENT OF RAILROAD BRIDGE AS AFFECTED BY NAVIGABILITY OF RIVERS).
266 App Div 452, 43 NYS2d 189-92 (1943).

Descriptors: *New York, *Bridges, *Taxes, *Navigable rivers, Navigable waters, Assessments, State governments, Governments, Government finance, Rivers, Railroads, Transportation, Judicial decisions, Legal aspects, Water law, Navigation.

Plaintiff railroad sought to cancel a franchise tax assessment, levied by defendant state tax commission, on plaintiff's bridge over a river. The sole issue was whether the river was navigable at the point of crossing. Plaintiff contended that it was not navigable and therefore not subject to a franchise tax. Defendant contended that the river was navigable. Reversing a judgment for plaintiff, the court held that the river was navigable. The court noted that a stream is navigable if it is capable of floating a single log to market during a part of the year, and even disuse for 100 years does not cause the river to lose its navigable character. One justice dissented. (Liptak-Florida)
W71-01426

SCHROEDER BESSE OYSTER CO V UNITED STATES (DAMAGE TO OYSTER BEDS THROUGH DREDGING).
95 Ct C1 729-40 (1942).

Descriptors: *United States, *Rivers and Harbors Act, *Commercial shellfish, *Ownership of beds, Boundaries (Property), Federal government, Industries, Judicial decisions, Land tenure, Legal aspects, Legislation, Proprietary power, Damages, Bays, Dredging, Oysters, Channel improvement, Massachusetts.

Pursuant to the Rivers and Harbors Act of 1935, defendant United States commenced and continued dredging operations during the years 1936 and 1937 in the proximity of Onset Bay, Massachusetts. Plaintiff owned certain areas of the bed of Onset Bay on which it was licensed to cultivate and harvest oysters. Mud and silt from the dredging operation killed most of plaintiff's harvestable oysters and rendered the land on which they grew unusable for that purpose. In addition, plaintiff claimed that its recently planted seed oysters, which would have brown into a large crop of harvestable oysters, were also destroyed. The court ranted full compensation for damages to the mature oysters and the oyster beds. It refused compensation for the seed oysters, however, holding that their successful maturity into a harvestable crop was speculative, and speculative damages were not allowable under the terms of the act. (Clarke-Florida)
W71-01427

DOONER V UNITED STATES (ARTIFICIALLY INDUCED FLOOD DAMAGE).
95 Ct C1 392-400 (1942).

Descriptors: *United States, *Community development, *Flood damage, *Canals, Boundaries (Property), Federal government, Judicial decisions, Legal aspects, State governments, Proprietary power, Relative rights, Riparian land, Riparian rights, Riparian waters, Usufructuary right, Watercourses (Legal), Damages, Floods, Cost allocation.

Plaintiffs owned property adjacent to a canal. The State of Illinois undertook to deepen and enlarge such canal, but ran out of funds before the work could be completed. Defendant United States provided the funds and supervision to complete the project. During the course of such construction the water level of the canal was raised, and plaintiffs' lands were completely submerged. The court found from the facts that at the time the state ceased work on the canal, plaintiffs' lands were above water. Defendant's contribution to the project alone caused the water level to rise and flood plaintiffs' lands. Consequently, plaintiffs were allowed to recover in full the value of their property. (Clarke-Florida)
W71-01428

BRAEBURN ALLOY STEEL CORP V UNITED STATES (GOVERNMENT'S LIABILITY FOR DAMAGES CAUSED BY UNPRECEDENTED FLOOD).
95 Ct C1 343-57 (1942).

Descriptors: *Historic flood, *Dams, *Subsidence, *Federal government, Washouts, Pennsylvania, United States, Maximum probable flood, Disasters, Flood damage, Dikes, Riparian land, Erosion, Overflow, Floods, Cloudbursts, Governments, Navigation, Damages, Remedies, Eminent domain, Judicial decisions, Legal aspects, Settlement (Structural).

Plaintiff steel company brought action against defendant United States to recover damages resulting when flood waters overflowed defendant's dam and dike, with the result that subsequent erosion caused plaintiff's factory and office building to fall into the river. Plaintiff contended that defendant was negligent in constructing and maintaining an inadequate dam adjacent to plaintiff's riparian property and that the resultant damage was in the nature of a taking of property for a public use. Defendant argued that the flood was unprecedented, that the dam was constructed according to good engineering practice, and that the dam was sufficient to withstand any previously known flood. Noting the distinction between a taking for a public purpose and consequential damage resulting from legitamate governmental activity, the court dismissed plaintiff's claim. (Liptak-Florida)
W71-01429

RODEN COAL CO V UNITED STATES (GOVERNMENT'S LIABILITY FOR SUBSIDENCE DAMAGE CAUSED BY CHANNEL DREDGING).
95 Ct C1 219-231 (1941).

Descriptors: *United States, *Channel improvement, *Dredging, *Subsidence, Bank erosion, Canals, Canal construction, Navigation, Navigable waters, Piles (Foundations), Sheet piling, Bulkhead line, Bulkheads, Retaining walls, Governments, Compensation, Condemnation, Eminent domain, Damages, Riparian land, Judicial decisions, Legal aspects, Legislation, Coal mines.

Plaintiff coal company brought action against defendant United States to recover for subsidence damage to plaintiff's riparian coalyard. The subsidence was allegedly caused by defendant's adjacent canal-dredging operations. Plaintiff contended that subsidence damage and bulkhead failure caused by defendant's dredging amount to a constructive taking of property under the fifth amendment. Defendant argued that the damage was the consequential result of the government's exercise of its lawful authority to maintain a navigable waterway. The court held that liability did not rest on the government unless specifically authorized, and the act authorizing the dredging did not authorize claims for consequential damage. The court further found that the damage was due to plaintiff's negligence in not providing an adequate bulkhead or sufficient foundations for its coal derricks and other heavy shore equipment. (Liptak-Florida)
W71-01430

MOUNDSVILLE WATER CO V MOUNDSVILLE SAND CO (TRESPASSER'S LIABILITY FOR DAMAGE TO WATER SUPPLY LINE).
19 SE2d 217-221 (W Va 1942).

Descriptors: *West Virginia, *Public utilities, *Water loss, *Water supply, Public rights, Naviga-

ble rivers, Riparian land, Ownership of beds, River beds, Water pollution, Turbidity, Pumping, Water wells, Water shortage, Pumping plants, Right-of-way, Legal aspects, Judicial decisions, Remedies, Damages, Federal government, State governments.
Identifiers: Moundsville (West Virginia).

Plaintiff water company sought an injunction to require defendant sand company to allow it access to a waterline to make repairs. Plaintiff also sought damages. Defendant had driven pilings into the river bank to prevent erosion and one piling had broken a pipeline carrying water from an underwater well to a pumping station, allowing mud to enter the waterline and forcing its disuse. Defendant also had accumulated a large pile of gravel at the river bank which obstructed plaintiff's access to the pipeline. Defendant argued that plaintiff had not received a right-of-way grant for the line. The Supreme Court of Appeals of West Virginia ruled, however, that the line had been there 36 years, giving plaintiff the protection of a license against a trespasser. The court said injury to a utility affecting the public is grounds for an injunction. The court also stated that plaintiff had an easement from a common grantor for access, and ordered defendant to pay for damages resulting from the break in the pipeline up to the time it removed the gravel and repaired the pipeline. (Morris-Florida)
W71-01431

OAKWOOD SMOKELESS COAL CORP V MEADOWS (LIABILITY FOR DAMAGE RESULTING FROM NORMAL OPERATION OF COAL MINE).

184 Va 168, 34 SE2d 392-397 (1945).

Descriptors: *Virginia, *Coal mine wastes, *Water pollution sources, Reasonable use, Legal aspects, Judicial decisions, Remedies, Springs, Seepage, Coal mines, Acidic water, Water pollution, Natural flow, Percolating water, Runoff, Mining, Air circulation, Ventilation, Real property, Relative rights.

Plaintiff spring owners sued for damages caused to their spring by polluted water percolating from defendant's coal mine. The property rights of both parties were obtained from a common grantor. Defendant received his lease on mineral rights prior to plaintiff's purchase of his property, and constructed a coal mine which, because of the necessity for ventilation, accumulated water. The water flowed from the mine down a hill, and some seeped into plaintiff's spring. Plaintiff contended that defendant was liable because operation of the mine caused his damages, but defendant insisted that the lease gave him a right to normal operation of a coal mine, including use of natural drainage channels. The Supreme Court of Appeals of Virginia reversed a lower court decision for plaintiff, and held that since the lessor placed no restrictions on normal operation of a coal mine, plaintiff took the deed to his land subject to the defendant's rights. (Morris-Florida)
W71-01432

CITY OF ATLANTA V SCOTT (PROPERTY DAMAGE RESULTING FROM STREET DRAINAGE).
18 SE2d 76-80 (Ga Ct App 1941).

Descriptors: *Georgia, *Cities, *Highway effects, *Adjudication procedure, Legislation, Drainage, Judicial decisions, Legal aspects, Highways, Roads, Damages, Drains, Local governments, Grading, Real property, Surface drainage, Erosion, Drainage water, Paving, Ponding, Surface waters, Effects, Remedies, Road construction.
Identifiers: Atlanta (Georgia).

Defendant city paved and graded a street adjacent to plaintiff's property. Plaintiff contended that the grading resulted in the diversion of large amounts of surface water onto her property and caused damge to her house and grounds. Plaintiff further contended that the drains installed by defendant were inadequate and that cracking of one drain resulted in further damage to her property. Defendant contended that the complaint failed to allege notice to the city within 90 days of the damage as required by statute. However, the trial court overruled defendant's demurrer on this ground. The Court of Appeals of Georgia reversed. Georgia statutes require that notice must be given the city within 90 days from the infliction of injury before suit can be brought. The city's demurrer should have been sustained. (Dye-Florida)
W71-01433

PERRY V MORGAN (TITLE TO LANDS UNDER STATE GRANT).

219 NC 377, 14 SE2d 46-49 (1941).

Descriptors: *North Carolina, *Navigable waters, *Real property, *Land tenure, Governments, Navigation, Land, Streams, State governments, Judicial decisions, Legal aspects, Ownership of beds, Beds under water, Boundaries (Property), Running waters, Rivers, River beds, Bodies of water, Streambeds, Islands, Dredging.

The United States government dredged earth from a channel, depositing it on and enlarging an existing island. Plaintiff claimed title to the land under a 1937 grant from the state. Defendant contended that the newly created land fell within the bounds of a grant to defendant's successor in title in 1853. Plaintiff contended that: (1) parol evidence could not be admitted to interpret defendant's alleged grant; and (2) the land in question was covered by navigable water and was thus not subject to grant. The trial court excluded defendant's evidence as to both contentions and ruled for plaintiff. The Supreme Court of North Carolina reversed. Any ambiguity in defendant's grant was latent, and parol evidence should have been admitted to clarify the grant. Moreover, sufficient evidence was offered to present a proper question to the jury as to whether the property was covered by navigable waters at the time of defendant's grant. The existence of the grant was evidence of the non-navigability of the stream. (Dye-Florida)
W71-01434

LAWRENCE V CITY OF LA GRANGE (DAMAGES RESULTING FROM CITY DRAINAGE FACILITIES).
11 SE2d 696-699 (Ga Ct App 1940).

Descriptors: *Georgia, *Drains, *Erosion, *Damages, Legal aspects, Judicial decisions, Cities, Local governments, Real property, Drainage, Drainage effects, Drainage water, Pipes, Excess water (Soil), Surface runoff, Eminent domain, Remedies, Diversion, Floods, Surface drainage, Value, Land appraisal, Adjudication procedure.

Defendant city constructed drainpipes on plaintiff's property which caused erosion to plaintiff's land and consequent depreciation in the rental value of the property. Plaintiff contended that the pipes constituted a continuing nuisance for which defendant was liable. The Court of Appeals of Georgia stated three grounds under which defendant could be held liable: (1) if defendant's construction or maintenance of the drainage pipes was negligent; (2) without regard to negligence, if plaintiff's life or health was endangered; and (3) under the Georgia constitution, if defendant's actions constituted a taking of private property without compensation. As to the first two grounds, plaintiff alleged in her complaint neither negligence nor danger to her life and health. Plaintiff's suit was brought more than four years after the construction of the pipes, thus the statute of limitations barred action under the consitutional provision governing uncompensated taking of private property. The court affirmed the trial court's dismissal of plaintiff's complaint. (Dye-Florida)
W71-01435

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS).
190 SE 787-789 (Ga 1937).

Descriptors: *Georgia, *Cities, *Natural flow doctrine, *Obstruction to flow, Flooding, Flood damage, Ponding, Damages, Water injury, Mosquitoes, Public health, Judicial decisions, Legal aspects, Adjudication procedure, Relative rights, Surface runoff, Surface drainage.
Identifiers: Rome (Georgia).

Plaintiff municipal property owner sued defendant city for damages resulting from defendant's alteration of the street and curb level in front of plaintiff's property. Defendant had raised the street and sidewalk level 14 inches, creating a dam effect and preventing natural drainage of surface water from plaintiff's lot. The standing water caused the floors in plaintiff's house to rot and proliferated mosquitoes. Plaintiff contended that defendant's acts were negligent and created a nuisance. The court stated that when a city, in constructing a public improvement, obstructs the natural drainage of surface water, thus creating a pond upon contiguous land without providing other drainage, it is liable for damages. The court noted that defendant might also be held liable for nuisance. Finding that the lower court had properly overruled defendant's demurrer, the court affirmed the judgment for plaintiff. (Hart-Florida)
W71-01436

HAMPTON V TOWN OF SPINDALE (DISCHARGE OF INDUSTRIAL WASTES INTO MUNICIPAL SEWER SYSTEM).

210 NC 546, 187 SE 775-777 (1936).

Descriptors: *North Carolina, *Cities, *Industrial wastes, *Water pollution, Chemical wastes, Industrial plants, Soil contamination, Water pollution sources, Municipal water, Impaired water quality, Pollutants, Public health, Water pollution effects, Odor, Domestic wastes, Municipal wastes, Sewers, Sewage disposal, Judicial decisions, Legal aspects, Adjudication procedure, Waste disposal.

Plaintiff landowner sued defendant city and mill and power companies for damages resulting from pollution of a stream running through plaintiff's land. The mill and power companies discharged industrial wastes into the municipal sewer system which in turn discharged into the stream. Defendant city owned and completely controlled its sewer system. Noting that persons on whose initiative a sewer system is constructed are not liable for its use after the municipality assumes control, since the proximate cause of the damage is not construction but operation of the sewer, the court held that the mill and power companies were not liable to plaintiff. Plaintiff submitted a voluntary nonsuit as to defendant city. (Hart-Florida)
W71-01437

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS).
186 SE 708-710 (Ga Ct App 1936).

Descriptors: *Georgia, *Cities, *Natural flow doctrine, *Obstruction to flow, Flooding, Flood damage, Ponding, Damages, Water injury, Judicial decisions, Legal aspects, Adjudication procedure, Surface runoff, Surface drainage.
Identifiers: Rome (Georgia).

Plaintiff property owner sued defendant city for damages resulting from defendant's alteration of the street and curb level in front of plaintiff's home. Defendant had raised the street and sidewalk level 14 inches, creating a dam effect and preventing natural drainage. The standing water caused plaintiff's house to begin to rot. Plaintiff contended that defendant's acts were negligent and created a nuisance. The court stated that when a city, in mak-

ing public improvements, obstructs natural flow of surface water without providing an outlet, it becomes liable in damages. The court stated also that if the ponding created a nuisance, the city could be held liable. The decision of the lower court for plaintiff was affirmed. (Hart-Florida)
W71-01438

CUNNINGHAM V PREVOW (TITLE TO PROPERTY FORMED BY ACCRETION).

192 SW2d 338-352 (Tenn Ct App 1945).

Descriptors: *Tennessee, *Accretion (Legal aspects), *Land tenure, *Riparian land, Bank erosion, Boundaries (Property), Rivers, Avulsion, Legal aspects, Judicial decisions, Boundary disputes, Relative rights, Channels, Channel erosion, Riparian rights, Real property, Erosion, Banks.

Plaintiff and defendant both claimed title to land which had re-formed by accretion in an area formerly occupied by plaintiff, but which had peviously been eroded away by changes in a certain river's channel. The temporary channel abutted on defendant's property, and when the river gradually moved back to its original channel, defendant claimed that the portion of the plot accreting onto his property belonged to him. Plaintiff argued that land formed by the process of accretion in place of land lost by erosion was regained to the owner of the land that was washed away. The court rejected this contention, holding that where land bordering on a stream is washed away and an accretion to the land of another subsequently extends over the same place, the naturally formed land belongs to the owner of the land to which it is an accretion, and not to the one originally owning the land in that place. Prior cases to the contrary were distinguished as dealing largely with avulsion, and the trial court's decision for the plaintiff was reversed. (Caldwell-Florida)
W71-01439

KENTON V MASSMAN CONST CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF A DIKE).
164 SW2d 349-353 (Mo 1942).

Descriptors: *Missouri, *Dikes, *Flood damage, *Construction, Legal aspects, Flooding, Flood control, Navigable rivers, Missouri River, Judicial decisions, Engineering structures, Diversion structures, Remedies, Concrete structures, Channel width, State governments, Federal government, Supervisory control (Power).

Plaintiff landowner sued defendant construction company for damages caused to plaintiff's land and crops by flooding which resulted from defendant's construction of a dike in the Missouri River. Plaintiff contended that defendant had extended the dike too far across the river and failed to leave the customary channel width according to government regulations. Plaintiff further contended that a screen mat was attached to the dike which was not authorized by the United States in the construction contract and that this mat was the cause of the flooding since it obstructed the flow of water. Defendant contended that the United States had authorized the work at defendant's specification and that defendant had constructed the dikes under the supervision and by the approval of the Corps of Engineers. The Supreme Court of Missouri held that plaintiff failed to prove that defendant had negligently constructed the dike in violation of its contract with the United States. (Quesada-Florida)
W71-01440

MISSOURI PAC RR V SALE (VESTED LAND RIGHTS SURVEYED AND DISPOSED OF BY FEDERAL GOVERNMENT NOT AFFECTED BY RE-SURVEY).
127 SW2d 133-135 (Ark 1939).

Descriptors: *Arkansas, *Surveys, *Public lands, *Patents, Reclamation, Federal reclamation law, Public rights, Governments, Legal aspects, Judicial decisions, Swamps, Land reclamation, Accretion (Legal aspects), Proprietary power, Leases, Relative rights, Riparian rights, Riparian land, Water rights, Real property.

According to an 1845 United States survey, appellee's land, located in a river bend, consisted of 97 acres. A 1929 re-survey listed 160 acres in the same tract. The discrepancy was caused either by an initial recordation error or by accretion. Subsequent to the re-survey, the General Land Office issued appellant railroad company a patent covering appellee's land, including the increased acreage. The Commissioner of the General Land Office overruled appellee's protest of appellant's claim to the land. Appellee then brought an action against a lessee, whose tenancy had terminated, to recover possession of said land. Appellant intervened, claiming title to the land. The Supreme Court of Arkansas, in affirming the lower court's judgment, held that where appellee's vested rights had been acquired under an 1845 survey, a 1929 re-survey of the same tract was void. Therefore, the General Land Office was without authority to grant appellant a patent under the later survey, not withstanding the fact that the later survey showed increased acreage. (Powell-Florida)
W71-01441

HAUPT V PRUSE (BOUNDARY DISPUTE FOLLOWING SHIFT IN CHANNEL OF RIVER).
277 Ky 120, 125 SW2d 782-784 (1938).

Descriptors: *Kentucky, *Patents, *Islands, *Boundaries (Property), Rivers, Boundary disputes, Bayous, Meanders, Legal aspects, Judicial decisions, Accretion (Legal aspects), Bodies of water, Ponds, Streams, Navigable rivers, Land, Land tenure, Real property.
Identifiers: *Sloughs.

A 1796 patent described a large island as bounded on the north by the Kentucky River. An 1858 patent described a smaller island which was located to the north of the large island. The thread of the Kentucky River, which at the time of trial ran to the north of the smaller island, previously ran along a slough between the two islands. Appellees, heirs of the 1858 patentee, brought an action for the sale of the smaller island and for a division of proceeds. Appellant, owner of the large island, intervened. Appellant contended that the 1796 patent included the smaller island since the norther boundary of the larger island was the Kentucky River as it ran at the time of trial. Appellee contended that the boundary line quoted from the 1796 patent was intended to follow a slough in which the Kentucky River formerly ran, and that the smaller island lay between the slough line and the river. The Kentucky Court of Appeals, in affirming a judgment for appellee, held that the evidence supported a finding that the smaller island was not included in the 1796 patent. (Powell-Florida)
W71-01442

GENERAL AMERICAN LIFE INS CO V DUNKLIN COUNTY (PATENT OF SWAMPLAND TO STATE).

96 SW2d 380-384 (Mo 1936).

Descriptors: *Missouri, *Swamps, *Land reclamation, *Drainage, Legal aspects, Judicial decisions, Remedies, Federal government, State governments, Local governments, Legislation, Ownership of beds, Boundaries (Property), Patents, Beds under water, Water policy, Drainage programs, Land use, Reclamation states, Real property.

Plaintiff corporation sought to be declared owner of former swampland which a predecessor-in-title allegedly had purchased from defendant county. The land was allegedly granted to the state from the United States by an 1850 act of Congress, which the state in 1853 granted to the county, which in turn sold it to a predecessor in plaintiff's chain of title. The court found, however, that fee simple title did not actually pass from the county to the predecessor because the land was not accurately plotted until 1933. Therefore, the congressional act did not patent the land to the state until then. The state again transferred its patent to the county in 1934. The court held the land was granted from the federal government to the state and thence to the county and plaintiff's predecessor in the 1850s, and the title available after the patent was issued in 1933 became perfect retroactively as of the date of the original grant. The plaintiff had beneficial title between 1850 and 1934, and the subsequently perfected fee simple title related back to the date of the original transfers. (Morris-Florida)
W71-01443

MIAMI CORP V STATE (STATE OWNERSHIP OF PROPERTY OF LAND SUBMERGED BY EROSION AND SUBSIDENCE).
186 La 784, 173 So 315-343 (1937).

Descriptors: *Louisiana, *Boundary disputes, *Bank erosion, *Ownership of beds, Accretion (Legal aspects), Boundaries (Property), Real property, Land tenure, Riparian land, Riparian rights, State governments, Navigable rivers, Navigable waters, High water mark, Lakes, Streams, Judicial decisions, Legal aspects, Water law, Legislation, Public lands, Subsidence.

Plaintiff riparian owner brought an action against defendant state to establish the boundary of plaintiff's property, a portion of which had become submerged as a result of gradual erosion and subsidence. Plaintiff claimed title up to the boundary as it existed when he purchased the land and contended that a statute vesting title in the state to beds of navigable rivers did not apply since his land was on a lake. Defendant contended that the bed of all navigable waters belonged to the state and that plaintiff's land was on a lake in name only, the 'lake' being merely a wide section of a river. Overruling precedent to the contrary, the court affirmed a judgment for defendant and held that, since plaintiff's land was now submerged, it was obviously part of the lake bed and therefore public property. The court noted that such a result was dictated by public policy and that plaintiff's loss was offset by the possibility of the situation being reversed by accretion. Two justices dissented. (Liptak-Florida)
W71-01444

STATE EX REL RICE V STEWART (TITLE TO BEDS OF NAVIGABLE STREAMS).
184 So 44-52 (Miss 1938).

Descriptors: *Mississippi, *Ownership of beds, *Navigable waters, *Inlets (Waterways), Streambeds, Rivers, Navigation, High water mark, Riparian rights, Public rights, Riparian land, Legal aspects, Damages, Judicial decisions, Federal government, State governments, Governments, Navigable rivers, Streams, River beds, Tidal waters, Mississippi River, Estuaries, Tides.

Defendants, riparian owners of property on a navigable inlet of the Mississippi River, removed sand and gravel from the bed of the inlet. Plaintiff state sought damages to the value of the gravel removed, contending that the bed of a navigable stream where the tide ebbs and flows is held in trust for the public by the state and that, as trustee, the state may bring an action for trespass on behalf of the public. Defendants contended that the rule governing navigable rivers above the tide's ebb, vesting title to streambeds in riparian owners, applied to waters where the tide ebbs and flows as well. The Supreme Court of Mississippi, recognizing that a rule applied in some states treats all navigable waters in the same fashion, applied the rule of the forum and common law, holding title in streambeds to be in the state. The court further held that the state was entitled to any remedy open to a common trustee and could maintain an action

for trespass. Damages were to be assessed to the value of the property removed, without allowance or deductions for labor or expenses incurred in removing it. (Dye-Florida)
W71-01445

CASSO V ASCENSION REALTY CO (DISPUTE AS TO OWNERSHIP OF BOTTOM LAND AND SURROUNDING WATERFRONT PROPERTY.
190 So 198-204 (La Ct App 1939).

Descriptors: *Louisiana, *Ownership of beds, *Boundary disputes, *Boundaries (Property), Navigable waters, Riparian rights, Judicial decisions, Beds under water, Harbors, Patents, Remedies, Saline water, Tidal waters, Beds, Real property, Land tenure, Legal aspects.

Plaintiff vendee sought to have himself recognized as full owner of the bed of a small port and some of the surrounding waterfront realty. In addition, plaintiff sought to have defendant realty company's possessory action barred. Plaintiff contended that he had acquired title from a vendor whose husband acquired a patent to the land in question from the State of Louisiana. Defendant contended that it had title through the devisee of a claimant prior to the issuance of the patent in plaintiff's chain of title. Moreover, defendant contended that the holder of the patent in plaintiff's chain of title had entered into a compromise with the original grantor in defendant's chain of title by which the holder of the patent relinquished all claims to the bottom land and waterfront realty in question in exchange for other lands. Court of Appeal of Louisiana held that defendant's chain of title was the true one by reason of the compromise entered into by the husband of plaintiff's vendor. (Quesada-Florida)
W71-01446

FLORIDA EX REL MYERS V CONE (LEASING SALT WATER BEDS).
190 So 698-701 (Fla 1939).

Descriptors: *Florida, *Leases, *Saline soils, *Legislation, Saline water, Public rights, Legal aspects, Judicial decisions, Ownership of beds, Riparian rights, Navigable waters, Tidal waters, Oysters, Commercial shellfish, Administrative agencies, Administrative decisions.

Relator applicant sought a writ of mandamus to compel respondent State Board of Conservation to lease certain salt water bottoms to him as required by the provisions of a Florida statute. Respondent contended that the statute under which relator claimed the rights to the lease was superseded by a later statute. Relator contended that the statute providing that the first applicant for a lease on salt water bottoms for oyster beds must be given the lease if qualified unless the other applicants were the riparian owners was not superseded. The Supreme Court of Florida held that the later statutes defining the powers of the State Board of Conservation in no way superseded or repealed the statute in question, and hence relator was entitled to the lease upon proof of the alleged facts. (Quesada-Florida)
W71-01447

MILLER V BAY-TO-GULF, INC (BOUNDARY DISPUTE OVER BEACHFRONT PROPERTY).
193 So 425-429 (Fla 1940).

Descriptors: *Florida, *Riparian land, *Boundary disputes, *Tides, Intertidal areas, Moon, Sea level, Tidal waters, High water mark, Low water mark, Boundaries (Property), Bank erosion, Bulkheads, Retaining walls, Riparian rights, Beach erosion, Erosion control, Riparian waters, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff landowner sought an injunction to restrain defendant corporation from demolishing plaintiff's bulkhead, and sued to quiet title to certain beachfront property. Defendant had conveyed a lot to plaintiff near the beachfront; plaintiff erected two bulkheads between this lot and the Gulf of Mexico to prevent erosion. Defendant sought to convey the strip between plaintiff's lot and the gulf, and wished to remove the bulkheads. Plaintiff contended among other things that since erosion of the beach had caused the high water mark to reach plaintiff's lot, title to the strip sought to be conveyed by defendant was vested in him. The court stated that plaintiff would be entitled to riparian rights if the ordinary high tide extended to his boundary, noting that claim of title because of erosion by tidal waters must be strictly construed. The court held that ordinary high tide did not refer to monthly spring tides, but to the limit reached by the daily usual tide, or the neap tide between the full and change of the moon. Since the lower court's finding that the ordinary high tide had not reached plaintiff's land was not clearly erroneous, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01448

IN RE VICKSBURG BRIDGE AND TERMINAL CO (CORPORATIONS ABILITY TO MORTGAGE BRIDGE CONSTRUCTED ON STATE-OWNED RIVERBED).
22 F Supp 490-507 (SD Miss 1937).

Descriptors: *Louisiana, *Ownership of beds, *Public rights, *Bridges, Mississippi, Judicial decisions, Legal aspects, Railroads, Concrete structures, Navigable rivers, River beds, Boundaries (Property), Transportation, Public benefits, Legislation, Financing, State governments.

Intervenor creditors in a bankruptcy action against defendant bridge company sought to attack the validity of the claims of other creditors. Intervenors contended that defendant could not mortgage a certain bridge because it was constructed on beds to which the state held title in trust for the public. The bondholders and other creditors contended that the State of Louisiana authorized the construction of the bridge for the public benefit and authorized the mortgaging of the structure. The court held that the bridge company had properly complied with Louisiana statutory provisions for the construction of the bridge and for permission to mortgage the structure, and therefore the mortgage was valid. (Quesada-Florida)
W71-01449

THE SS NEA HELLIS (FINES FOR DISCHARGING OIL INTO NAVIGABLE WATERS).
32 F Supp 115-116 (SD NY 1940).

Descriptors: *Oil, *New York, *Ships, *Legislation, Water pollution, Water pollution control, Navigable waters, Coasts, Oil wastes, Water pollution sources, Admiralty, Legal aspects, Judicial decisions, Pollutants, Fuels, Oily water, Federal government, Water law, Harbors, Adjudication procedure.
Identifiers: *Oil Pollution Act, *New York Harbor Act.

The United States brought a libel action in admiralty against defendant steamship to impose a fine for discharging oil into New York Harbor. The action was brought under the Oil Pollution Act of 1924 which prohibited the discharge of oil into the coastal navigable waters of the United States. Defendant contended that the Oil Pollution Act did not apply to the alleged violation. Instead, defendant contended that the alleged violation was governed solely by the New York Harbor Act of 1888 which prohibited discharge of oil into the waters of the harbor of New York. It was agreed that both federal statutes applied to the same subject matter. Under the principle that where there are two statutes upon the same subject--the earlier being special and the later general--the special serves as an exception to the general, the court held that the Oil Pollution Act was not applicable. The New York Harbor Act was a special statute and as such was controlling over the Oil Pollution Act. Action under the Oil Pollution Act was thus dropped. (Snow-Florida)
W71-01450

SIMMONS V UNITED STATES (LIABILITY FOR FLOOD DAMAGES CAUSED BY CONSTRUCTION OF A DAM).

32 F Supp 302-303 (WD Ky 1940).

Descriptors: *Kentucky, *Dams, *Flooding, *Gradually varied flow, Damages, Engineering structures, Overflow, Rivers, River flow, Flow, Floods, Navigable rivers, Ohio River, Obstruction to flow, Alteration of flow, Silts, Federal government, United States, Judicial decisions, Condemnation, Compensation.

Plaintiff brought an action to recover the value of his land allegedly taken by the United States. Plaintiff contended that the United States had constructed a dam on the Ohio River which resulted in his land on the Salt River, a tributary of the Ohio River, being flooded. Plaintiff contended that the fifth amendment required just compensation for such taking. Defendant contended that the flooding was not the immediate result of the erection of the dam so as not to be within the meaning of 'taking' under the fifth amendment. The court found that the flooding was not the immediate result of the erection of the dam since the dam merely stopped the flow of the Salt River which permitted debris and silt to accumulate and fill the river channel. After a period of time, this accumulation cased the river to overflow its banks. The court held that the taking was gradual rather than immediate, and as such did not constitute a taking for which compensation was required. (Snow-Florida)
W71-01451

KUHNERT V UNITED STATES (FLOOD DAMAGES FROM RIVER OVERFLOW CAUSED BY DIKE CONSTRUCTION).
36 F Supp 798-804 (WD Mo 1941).

Descriptors: *Ice jams, *Dikes, *Overflow, *Navigation, Flood damage, Navigable rivers, Navigable waters, Rivers, Engineering structures, Barriers, Diversion structures, River training, Damages, Flooding, Floods, Riverflow, Flow, Flow around objects, Natural flow, Obstruction to flow, Judicial decisions, Legal aspects, Federal government.

Plaintiff brought an action against the United States for damages from flooding. Plaintiff contended that defendant had defectively constructed a dike on the Missouri River in that the dike extended so far out into the river as to greatly narrow the river's channel and impeede the river's flow. Floating ice jammed the river at that point and dammed the water, causing the river's level to be raised and overflowing plaintiff's farm. Defendant contended that the dike was constructed pursuant to the government's power to improve navigation of navigable waters and that the dike was not constructed negligently. From the evidence the court found that the dike was constructed in a careful and prudent manner. The best engineering principles had been applied, and it was unforseeable that the overflow would result. Accordingly, the court ruled for the plaintiff. (Snow-Florida)
W71-01452

SOUTH CAROLINA EX REL MAYBANK V SOUTH CAROLINA ELEC AND GAS CO (JURISDICTION OVER NAVIGABLE WATERS).
41 F Supp 111-119 (ED SC 1941).

Descriptors: *United States, *Federal government, *Federal jurisdiction, *Navigable waters, Judicial decisions, Jurisdiction, Legal aspects, Legislation, State governments, Water contracts, Contracts, Watercourses (Legal), Canals, Adjudication procedure.

Action was brought by plaintiff state against defendant corporation for breach of contract for defendant's failing to keep a canal open for navigation. Defendant petitioned to have the case heard in federal court on the grounds that the canal was navigable, and thus subject to federal jurisdiction. In dismissing the action, the court held that the question of navigability is not a federal question in the jurisdictional sense, and the fact that a body of water is found to be navigable will not automatically give federal courts jurisdiction of matters in litigation concerning it. (Clarke-Florida)
W71-01453

UNITED STATES V THE DELVALLE (UNINTENTIONAL WATER POLLUTION BY UNUSED FUEL OIL).
5 F Supp 746-748 (ED La 1942).

Descriptors: *Legislation, *Navigable rivers, Ships, *Water pollution sources, United States, Admiralty, Federal government, Federal jurisdiction, Legal aspects, Judicial decisions, Relative rights, Navigable waters, Fuels, Oil wastes, Pollutants, Coasts, Oily water, Regulation, Rivers and Harbors Act.

Defendant ship was prosecuted in rem under a federal statute making it unlawful to discharge refuse in the navigable waters of the United States. One of defendant's employees had negligently left a fuel valve slightly open, causing a fuel tank to overflow and discharge fuel oil into the Mississippi River. The court held that unused valuable fuel oil was not refuse in the ordinary meaning of the word, and the unintentional discharge thereof into navigable waters did not come within the meaning of the statute. (Clarke-Florida)
W71-01454

SOUND MARINE AND MACHINE CORP V WESTCHESTER COUNTY (INTERFERENCE WITH RIGHT OF ACCESS TO AND FROM NAVIGABLE WATERS).
5 F Supp 980-983 (SD NY 1942).

Descriptors: *New York, *Access routes, *Navigable waters, *Riparian rights, Navigation, Depth, Riparian waters, Harbors, Riparian land, Judicial decisions, Channels, Pipes, Pipelines, Damages, Deeds, Beds under water, Boats, Relative rights.

In an action in admiralty to recover damages, plaintiff corporation, owner of property abutting the waters of a harbor, contended that defendant had laid a sewer pipeline across the channel in the water in front of its property which damaged the property by decreasing the depth of the channel. Defendant contended that only nominal damages were due in that the decrease in depth of the channel in no way materially altered the value of the property. The court held that plaintiff, being a riparian owner, had the right to access to and from the navigable waters adjacent to its property and that defendant's improperly constructed pipeline was a trespass upon such right to access for which damages were due. However, the court ruled that the decrease in depth was not sufficient enough to prevent boats from docking at plaintiff's property. Thus only nominal damages were assessed. (Snow-Florida)
W71-01455

CITY OF GREENVILLE V MILLER (RIGHT OF STATE TO TAX INTERSTATE BRIDGE).
57 F Supp 344-350 (ED Ark 1942).

Descriptors: *Arkansas, *Bridges, *Mississippi River, *Taxes, Tariff, Costs, Cities, Administrative agencies, Administration, Regulation, Navigable rivers, Streams, Bridge construction, Financing, Operating costs, Highways, Federal government, Eminent domain, Easements, Right-of-way.

Plaintiff, a city located in Mississippi, brought suit for a declaratory judgment as to the claimed right of the State of Arkansas to tax plaintiff for that portion of the Greenville Bridge lying within the State of Arkansas. The bridge was built pursuant to congressional authorization as required for all bridges spanning navigable streams. The act of authorization fixed the terms under which it was built, all of which were for a public purpose. Under article 16 par. 5 of the Arkansas constitution, public property used exclusively for a public purpose is exempt from taxation. The court stated that the fact that plaintiff city was an arm of the State of Mississippi and was exercising governmental functions under authority of that state was not controlling. All the facts and circumstances showed that the bridge was used exclusively for a public purpose, and therefore Arkansas was without authority to assess taxes upon that portion of the bridge lying within its boundaries. (Barnett-Florida)
W71-01456

UNITED STATES V WEST VIRGINIA POWER CO (VALUATION OF PROPERTY CONDEMNED FOR DAM SITE).
56 F Supp 298-304 (SD W Va 1944).

Descriptors: *West Virginia, *Damsites, *Condemnation value, *Navigation, Sites, Engineering structures, Flood control, Reservoirs, Water control, Condemnation, Eminent domain, Compensation, Flow, River flow, Riparian rights, Navigable rivers, Rivers, Navigable waters, Federal government, United States, Judicial decisions, Reservoir sites, Dams.

In a condemnation proceeding by the United States to acquire lands for a reservoir to be created by the erection of a dam for flood control purposes, condemnee property owner contended that it had the right to compensation for its land on the basis of a valuation of the land for water power and damsite purposes. The United States contended that the dam was constructed pursuant to the government's power to control navigation on navigable waters, and as such it possessed a dominant easement in the flow of the water at the damsite so as to preclude a riparian landowner from having any benefits of the water flow for which compensation would be due. The court held that the dam constructed for flood control purposes was done pursuant to the plenary power of the government to control navigation. By the exercise of such power, the government asserted its dominant right to the water's flow and as such the riparian owner could properly be excluded from any benefits of such flow without compensation. Thus the value of the land as a damsite locality was not to be considered in the condemnation award. (Snow-Florida)
W71-01457

NORTHERN N H LUMBER CO V NEW HAMPSHIRE WATER RES BD (RIGHT TO USE RIVER FOR TRANSPORTATION OF TIMBER).
56 F Supp 177-181 (D NH 1944).

Descriptors: *New Hampshire, *Non-navigable waters, *Lumber, *Dams, Transportation, Navigable rivers, Navigable waters, Rivers, Navigation, Upstream, Damsites, Barriers, Judicial decisions, Federal government, Federal jurisdiction, State jurisdiction, Federal-state water rights conflicts, Administrative agencies.

In an action for damages, plaintiff contended that the state had constructed a dam across a river which prevented him from using the river for transporting timber. Plaintiff contended that the river was a navigable one, and as such any obstruction to it had to be authorized by Congress. Plaintiff contended that the state had not gotten such authorization and therefore had committed a wrong for which he was entitled to recover damages. The state contended that the construction of the dam was upon non-navigable waters and as such federal authorization was not required; instead, state law was to govern under which the state was immune from suit. The court held that it would abide by the Federal Power Commission's determination that the river was non-navigable, notwithstanding the fact that logs could be floated down it. The federal government thus had no interest in the dam, the matter being entirely within the jurisdiction of the state. Since the matter was not to be governed by federal law, the state could properly assert its immunity defense. (Snow-Florida)
W71-01458

UNITED STATES V FIVE ACRES OF LAND (LOW WATER MARK AS BOUNDARY FOR PROPERTY ADJACENT TO NAVIGABLE WATERS).
56 F Supp 628-634 (D Mass 1944).

Descriptors: *Navigable waters, *Boundaries (Property), *Low water mark, *Massachusetts, Condemnation, Eminent domain, Boundary disputes, Legal aspects, Boundaries (Surface), Earth-water interfaces, Judicial decisions, Taxes, Assessments, Federal government, Railroads, United States.

In a proceeding by the United States to take by eminent domain a parcel of land used as a marine railway, the city in which the property was located filed a petition for unpaid taxes. The owners of the property contended that the tax had been illegally assessed so as to preclude the city from receiving any of the condemnation proceeds. The owners, pointing to the fact that a portion of the track and machinery of the railway extended beyond the extreme low water mark, contended that it was illegal for the city to have assessed the entire railway as real property since under Massachusetts law, the outer limit of ownership of land adjacent to navigable water is the extreme low water mark. The owners thus contended that that portion of the railway which extended beyond the low water mark could not be assessed as real property. The court held that it was proper to have assessed the entire marine railway since it was operated as a unit and the bulk of the railway system was attached to the land. (Snow-Florida)
W71-01459

THE VICTOR (OBSTRUCTION TO NAVIGATION).
58 F Supp 928-930 (Ed La 1945).

Descriptors: *Louisiana, *Ships, *Rivers and Harbors Act, *Accidents, Admiralty, Bridges, Canals, Banks, Permits, Docks, Damages, Hazards, Judicial decisions, Legal aspects, Navigation, Administrative agencies, Navigable waters.

Libel was brought by the owners of a lugger against a tug for damages resulting from a collision. The facts as found by the District Court for the Eastern District of Louisiana were that libellant lugger was moored temporarily in a channel while picking up men and supplies, that libellee tug was towing two steel barges in the channel where libellant was moored, and that as a result of water and wind currents, the barges in tow swung into the side of libellant, causing it to sink. Libellee argued that it was not liable for the damage to the ship in that libellant was unlawfully moored in the channel in violation of the Rivers and Harbors Act of 1917. The court agreed that libellant's failure to procure a permit to moor in the canal was a violation of that act. The court held that when at the time of collision a ship is in actual violation of a statutory rule intended to prevent collisions, the burden of proof that such mooring was not a cause of the disaster is upon such ship. Libellant failed to meet this burden, and therefore the libel was dismissed. (Barnett-Florida)
W71-01460

STURGES V SCHOOL DISTRICT (LIABILITY FOR DIVERTING NATURAL FLOW OF WATER ONTO ANOTHER'S LAND).
33 Pa D and C 525-530 (1938).

Descriptors: *Pennsylvania, *Flow control, *Routing, *Diversion structures, Drainage systems, Ditches, Conveyance structures, Legal aspects, Ju-

dicial decisions, Public rights, Diversion, Cutoff walls, Relative rights, Alteration of flow.
Identifiers: Chester (Penn).

Plaintiff landowner brought suit against defendant school district for damages caused by defendant's diversion of the natural flow of the area's streams and groundwater onto plaintiff's land. Plaintiff contended that defendant, through the actions of its employees, constructed a wall and filled in the natural course of the area's streams and draining groundwater, thus causing all of the water in the area to be forced onto plaintiff's land at one point. Defendant contended that the alleged acts were carried on independently by its employees and that defendant was not liable for the negligent acts of its employees. The court held that defendant's acts constituted the creation of a nuisance for which it was liable. (Quesada-Florida)
W71-01461

SMITH V J S MOZINO AND CO (DISCHARGE OF WATER ONTO ANOTHER'S LAND).

31 Del County 326-329 (Pa Com Pl 1940).

Descriptors: *Pennsylvania, *Discharge (Water), *Land use, *Impounded waters, Damages, Real property, Erosion, Flow, Runoff, Surface runoff, Drainage water, Drainage, Drains, Pipes, Legal aspects, Judicial decisions, Graded, Land forming, Grading, Structures, Soil erosion, Gully erosion, Rainfall.

Plaintiff owned lands adjacent to property of defendant. Defendant graded his land and erected dwellings thereon without negligence. However, as a result of the grading and the construction of downspouts removing water from the roofs of the dwelling houses, water and soil were discharged onto plaintiff's property. Plaintiff contended that defendant had diverted the natural flow of the water and was liable for damages to plaintiff's property. Defendant contended that his actions constituted a non-negligent improvement of his property and imposed no liability on him for consequent damages. The court held that an owner of a lot who improves it without negligence is not liable for damages resulting therefrom unless he has diverted water from its natural course or collected it in volume and caused it to discharge on another's land. Here, defendant had caused water to be collected in volume on the roofs of his houses and discharged on plaintiff's property. He was ordered to stop the discharge of water and pay for elimination of damage caused by previous discharges. (Dye-Florida)
W71-01462

HARRINGTON V FOSTER (OWNERSHIP OF ACCRETION).
264 NW 51-54 (Iowa 1935).

Descriptors: *Olowa, *Accretion (Legal aspects), *Boundary disputes, *Riparian land, Missouri River, Erosion, Bank erosion, Boundaries (Property), Judicial decisions, Legal aspects, Land tenure, Riparian rights, Relative rights, Real property, Land forming.

Plaintiff claimed title to certain lands as accretions to land conveyed to him by his grantor. Defendant contended the land in question was his as the land to which the accretion attached was not riparian land at the time plaintiff's grantor had title thereto quieted in himself. Defendant also claimed the land through the conveyance of a tax deed from his grantor. The court discounted the effectiveness of the tax deed, and held that the property, title to which was quieted in plaintiff's grantor, was itself accreted lands and the decree quieting title gave plaintiff's grantor title to all land to the Missouri River, the southerly border of the land in contest. Consequently, the court held that plaintiff, as the present owner of the riparian land of his predecessor, was the owner of the accreted lands. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-01463

LUNDBERG V UNIV OF NOTRE DAME (REGULATION OF INTERFERENCE WITH NAVIGABLE WATERS).
285 NW 839-841 (Wis 1939).

Descriptors: *Navigable rivers, *Wisconsin, *Obstruction to flow, *Legislation, Navigable waters, Navigation, Transportation, Federal government, Legal aspects, Judicial decisions, Adjudication procedure, Prescriptive rights, Highways.
Identifiers: Northwest Ordinance, Obstruction to navigation.

Plaintiffs sought a rehearing on the question of whether the Northwest Ordinance, which governed several territories in 1787, dealt with physical obstructions to navigable waters or carrying places, created any rights in individuals to seek redress for such obstructions or located carrying places or imposed a servitude upon any particular land for such purposes. The factual issues considered in the prior opinion (282 NW 70) were not considered on rehearing. The court reviewed cases seeming to indicate that the ordinance was intended to prohibit only political regulations hampering freedom of commerce, but declined to issue this as its holding. Instead, the court concluded that even if the ordinance prohibited physical interferences with navigable waters or carrying places, it could only relate to established carrying places, not contemplated ones. Plaintiff would have to prove an established portage before obtaining judicial decision of the other question raised. (Morris-Florida)
W71-01464

TRUSTEES OF UNIVERSITY CO-OPERATIVE CO V CITY OF MADISON (DUTY OF CITY TO MAINTAIN CITY SEWER SYSTEM).

288 NW 742-747 (Wis 1939).

Descriptors: *Wisconsin, *Storm drains, *Flood damage, *Drainage effects, Damages, Flooding, Sewers, Rainwater, Rainfall intensity, Tile drains, Seepage, Surface waters, Judicial decisions, Legal aspects, Legislation, Cities, Storm runoff, Floodwater, Drains, Drainage engineering, Drainage practices, Drainage water, Drainage systems.

Plaintiff brought action to recover damages for injury to his property allegedly caused by defendant city's defective and clogged storm drain to which plaintiff's roof drainpipe connected. The court found the evidence to be sufficient to support the verdict that defendant was negligent in damaging the storm drain used by plaintiff and in failing to repair the defect after receiving notice thereof. The court stated that if a duly adopted and executed plan of sewage disposal becomes out of repair to the knowledge of the municipality, the duty devolves upon it to remedy the matter, and it is liable for failure to exercise ordinary care in respect thereto. The judgment for plaintiff was affirmed except as to a part of the damages allowed. As to that part of the damages, a new trial was ordered. (Price-Florida)
W71-01465

IN RE LAKE ELYSIAN HIGH WATER LEVEL (RIGHTS OF RIPARIANS TO HAVE LAKE LEVEL MAINTAINED).
293 NW 140-144 (Minn 1940).

Descriptors: *Minnesota, *Lakes, *Relative rights, *Overflow, Navigable waters, Ditches, Local governments, Legislation, Drainage, Outlets, Floods, Erosion, Judicial decisions, Legal aspects, Water levels, Lake morphology, Lake shores, Dams, Watersheds (Basins), Project purposes.

A ditch was constructed to enlarge the outlet from a lake. The purpose of such construction was to drain slough lands adjacent to the outlet and to control the overflow from the lake. Lands receiving benefit therefrom were assessed accordingly. Subsequently, erosion deepened the ditch, causing a lowering of the lake level. Defendant commissioner contended that the lake level should be restored and issued an order to that effect. Plaintiff landowners opposed the issuance of said order and contended that having paid the above mentioned assessments, they had a right to have the lake level maintained as it had developed over the years since the ditch was constructed. The court ruled that the purpose of the ditch construction was to drain surrounding areas and not to lower the lake level. That being the purpose of the project, it was that for which plaintiffs were assessed. Plaintiffs therefore had no vested right to have the lake maintained at the present lower level. No riparian owner has a right to complain of improvements made to maintain water at its natural level. The commissioner's order approving the restoration project was affirmed. (Price-Florida)
W71-01466

DOHANY V CITY OF BIRMINGHAM (DUTY OF CITY TO PROPERLY MAINTAIN SEWAGE DISPOSAL PLANT).
301 Mich 30, 2 NW2d 907-912 (1942).

Descriptors: *Michigan, *Sewage disposal, *Riparian rights, *Municipal wastes, Relative rights, Cities, Surface waters, Sewage, Watercourses (Legal), Outlets, Pollution, Pollutants, Rainfall intensity, Dams, Structures, Pumps, Pumping plants, Storm water, Sewers, Overflow, Drainage engineering, Legal aspects, Judicial decisions.
Identifiers: Birmingham (Mich).

Plaintiff landowner sought to enjoin defendant city from allowing raw sewage to overflow its dam during heavy rains and to flow across his property via a natural watercourse. Defendant relied on cases holding that a riparian owner is allowed reasonable use of a natural watercourse even to the extent of a certain amount of pollution. The court found that no part of the watercourse which ran through plaintiff's land was within the city limits, and therefore defendant was not a riparian owner on such watercourse. Defendant had a duty to care for its sewage disposal during excessive rainfall as well as during normal weather. Plaintiff's right to have the nuisance abated did not depend on the water being used for drinking or domestic purposes. The decree entered allowed a reasonable time for defendant to make repairs and enjoined the future discharge of raw sewage into the watercourse. (Price-Florida)
W71-01467

STEINBRAKER V CROUSE (ABANDONMENT OF PROPERTY IN NAVIGABLE WATERS).

182 A 448-452 (Md 1936).

Descriptors: *Maryland, *Salvage value, *Ships, *Ownership of beds, Admiralty, Contracts, Federal government, Judicial decisions, Legal aspects, Permits, Relative rights, State governments, Watercourses (Legal), Navigable waters, Remedies.
Identifiers: *Abandonment, Salvage operations.

Plaintiffs had acquired ownership to 169 ship hulls sunk in navigable waters pursuant to governmental permit. Defendants were residents of the area who were in the process of stripping the hulls of their scrap metal. Before reaching the issue of abandonment, the court stated that the vessels were located on land belonging to the state and that the interest of the federal government extended only to control of the water over the land, not to the soil itself. (Clark-Florida)
W71-01468

ASSELIN V BLOUNT (DEFINITION OF NAVIGABLE RIVERS).

14 A2d 696-701 (RI 1940).

Descriptors: *Rhode Island, *Admiralty, *Navigable rivers, *Commercial shellfish, Contracts,

Watercourses (Legal), Federal government, Judicial decisions, Legal aspects, Ownership of beds, Relative rights, State governments, Remedies, Damages, Navigation, Navigable waters, Navigable rivers, Oysters, Legislation.

While seeding defendant's oyster beds, the boat in which the deceased was riding sank, and he drowned. In deciding that the state workmen's compensation act, rather than admiralty law, was applicable in this case, the court had occasion to define navigable rivers as those which are susceptible of use in their ordinary condition as highways of commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water. (Clarke-Florida)
W71-01469

LOWER TP V CITY OF WILDWOOD (MIDDLE OF STREAM AS COMMON BOUNDARY).
31 A2d 807-809 (NJ Ct Err and App 1943).

Descriptors: *New Jersey, *Cities, *Boundaries (Property), *Streams, Judicial decisions, Legal aspects, Boundary disputes, Relative rights, Local governments, Real property, Navigable waters, Legislation.
Identifiers: Wildwood (New Jersey).

Plaintiff township brought action pursuant to statute against defendant city to appoint a commission to monument a mutual corporate boundary. Plaintiff contended that the boundary, a stream, had altered its course so as to change the original boundary. The court noted that the legislature had usually fixed the middle of the stream as the common boundary under these circumstances, and stated that at common law conveyances of land bounded by streams above tide water extended to the middle of the stream. In denying plaintiff's request for a commission, the court found that the statute permitted appointment of a commission only when the monumented boundary was capable of remaining inviolate, without further change. Since the stream could alter its course in the future, the statute was held inapplicable. (Hart-Florida)
W71-01470

SGARLATA V CITY OF SCHENECTADY (CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY STREAM BEING BACKED UP BY OBSTRUCTED CULVERT).

250 App Div 789, 294 NYS 768-772 (1937).

Descriptors: *New York, *Flood damage, *Obstruction to flow, *Cities, Surface drainage, Water injury, Natural flow doctrine, Streams, Streamflow, Flooding, Culverts, Drainage, Runoff, Rainwater, Surface runoff, Drains, Drainage systems, Judicial decisions, Adjudication procedure, Water law, Legal aspects, Local governments, Subsidence, Settlement (Structural).
Identifiers: Schenectady (N.Y.).

Plaintiff property owner brought action against defendant city to recover for damages caused by the overflow of a creek during heavy rainfall. Plaintiff contended that the flooding was caused by defendant's failure to clean silt, sediment, and debris from a culvert through which the creek flowed, thereby causing the creek to back up and overflow onto plaintiff's land. The flooding caused subsidence of plaintiff's buildings. Defendant argued that the culvert was cleaned out, and in any event, that a city is not liable for governmental functions such as drainage system maintenance. Affirming per curiam a judgment for plaintiff, the court held that the evidence was sufficient to sustain the referee's findings. Two justices dissented on the ground that none of the evidence was sufficient to establish a basis for defendant's liability. (Liptak-Florida)
W71-01471

KEARNS V TOWN OF BLOOMFIELD (PRESCRIPTIVE RIGHT TO USE DRAINAGE DITCH OVER PRIVATE PROPERTY).

138 A 386-387 (NJ 1927).

Descriptors: *New Jersey, *Surface drainage, *Easements, *Prescriptive rights, Natural flow doctrine, Cities, Local governments, Judicial decisions, Legal aspects, Drainage, Drainage practices, Drains, Ditches, Natural flow, Overflow, Surface waters, Flooding, Flood prevention, Alteration of flow, Obstruction to flow, Public benefits, Outlets, Drainage water, Land use.
Identifiers: Bloomfield (New Jersey).

Plaintiff landowner had filled in a ditch on his property which caused the water which ordinarily flowed therethrough to back up onto adjacent properties. Plaintiff sought to enjoin defendant town from trespassing on his property to remove such fill. Defendant contended it had a right to use the ditch for drainage, as it was the natural course of drainage for the area, and that it had acquired by prescription such drainage rights. The court ruled that defendant had the right to enter upon and make use of private property for the public good, that the draining of adjacent lands across plaintiff's lands through a well-defined channel for more than twenty years constituted an easement, that the ditch was the natural outlet for said waters and that defendant had a right to keep the watercourse open to prevent flooding and the creation of a public nuisance. Therefore, plaintiff was enjoined from interfering with defendant's clearing of the ditch. (Price-Florida)
W71-01492

ARKANSAS POWER AND LIGHT CO V HILLARD (CONDEMNATION OF LANDS TO BE FLOODED UNDER BACKWATERS OF A DAM).

47 SW2d 575-576 (Ark 1932).

Descriptors: *Arkansas, *Flooding, *Dams, *Backwater, Condemnation, Easements, Right-of-way, Floodwater, Design flood, Flood routing, Reservoirs, Legal aspects, Judicial decisions, Reservoir design, Roads, Culverts, Roadbanks, Road construction, Relative rights, Land tenure, Compensation.

Plaintiff brought an action to recover damages for the cost of constructing a fill and culvert across a flooded roadway. Plaintiff, having sold a portion of her property to defendant power company under condemnation proceedings arising from contemplated flooding of such property by the construction of a dam, contended that she had reserved the use of the roadway which passed over the condemned property. Plaintiff contended that the subsequent flooding of the road by the back waters of the dam violated such reservation and that she was thus entitled to the cost of building a fill and culvert to restore her use of the roadway. Defendant contended that there had been no agreement as to any reservation of the roadway and that the flooding of the roadway had been anticipated and revealed at the time of the sale of the property. The court held that there was no evidence of any reservation either in the deed or under a parol agreement. Finding no agreement that the road was not to be flooded, the court reversed the trial court's judgment for plaintiff. (Snow-Florida)
W71-01502

WATSON V CHESAPEAKE AND OHIO RY (RAILROAD'S LIABILITY FOR CHANGING SURFACE DRAINAGE BY ELEVATING TRACKS).
238 Ky 31, 36 SW2d 641-644 (1931).

Descriptors: *Kentucky, *Surface drainage, *Railroads, *Elevation, Legal aspects, Judicial decisions, Damages, Local governments, Legislation, Natural flow, Repulsion (Legal aspects), Drainage, Surface waters, Transportation, Right-of-way, Civil engineering, Public lands, Public rights, Cities, Highways, Diversion, Alteration of flow, Riddance (Legal aspects), Access routes.

Plaintiff property owner sued defendant railroad company for damages suffered after defendant raised the level of its tracks and added additional tracks in an alley adjoining plaintiff's property. Plaintiff claimed the change in elevation caused flooding of its property and damaged its right of ingress to and egress from the alley. Defendant asserted that it held an exclusive right to use of the alley. The Court of Appeals of Kentucky, in reversing the lower court's dismissal of the petition, held the city could not grant exclusive right to an alley dedicated to public use. Plaintiff had an easement for access to the alley. The court also found the natural drainage was from plaintiff's property into the alley, and thus the railroad was liable for any flood damage caused by elevation of its tracks which affected the natural drainage. The court stated that the measure of damages was the difference in market value of plaintiff's property before and after defendant's elevation of the tracks. (Morris-Florida)
W71-01518

ST LOUIS SAN FRANCISCO RY V MANNING (RAILROAD'S LIABILITY FOR DESTROYING NATURAL PROTECTION FROM RIVER OVERFLOW).
26 SW2d 579-581 (Ark 1930).

Descriptors: *Arkansas, *Embankments, *Overflow, *Diversion, Legal aspects, Judicial decisions, Damages, Railroads, Right-of-way, Ravines, Channels, Rivers, River flow, Flood damage, Floods, Surface runoff, Surface drainage, Farms, Natural flow, Currents (Water), Overland flow, Water injury.

Plaintiff farm owner sued defendant railroad company for damages which resulted from the flooding of her land allegedly caused by defendant's negligent cutting of a ditch through a natural ravine embankment protecting her land. The ravine ordinarily carried overflow waters of the Spring River back into the river. Defendant claimed that it did not obstruct or divert waters from any natural channel onto plaintiff's land and that the water for the period in question was so high it would have overflowed plaintiff's lands even if there had been no ditch. The Supreme Court of Arkansas, in affirming a judgment for plaintiff, held there was no difference in diverting stream waters onto land and cutting a natural barrier so as to release a swift current onto the land. The court noted further that the jury found it was the current from the overflow that caused the damage, rather than merely the overflow, and that, because of the ditch, a lower overflow was able to reach the land. (Morris-Florida)
W71-01519

JOHNSON V RATLIFF (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE).
233 Ky 187, 25 SW2d 355-357 (1930).

Descriptors: *Kentucky, *Surface drainage, *Rainfall intensity, *Riddance (Legal aspects), Boundaries (Property), Drainage effects, Drainage, Surface waters, Surface runoff, Rain, Rainfall-runoff relationships, Flood damage, Legal aspects, Judicial decisions, Retaining walls, Damages, Diversion.

Plaintiff homeowner sued defendant, who owned an adjoining lot, for damages allegedly caused by defendant's diversion of surface water through construction of a retaining wall. Plaintiff claimed that the diverted waters, after extensive rains, entered her basement. Defendant denied that the construction injured plaintiff and argued that he could not be liable for extraordinary rainfall. The Court of Appeals of Kentucky, in reversing a lower court decision for defendant, held extensive rainfall was not the same as extraordinary rainfall. The court ordered a new trial because of a jury instruction

which indicated plaintiff could not recover if he could have mitigated damages through exercise of ordinary care. A proper instruction would have told the jury to exclude that portion of the damages which plaintiff could have avoided through exercise of ordinary care and at reasonable cost. (Morris-Florida)
W71-01520

BARRILLEAUX V DELAUNE (LIABILITY FOR LEVEE OBSTRUCTING DRAINAGE SERVITUDE).
176 La 377, 145 So 776-779 (1933).

Descriptors: *Louisiana, *Surface drainage, *Easements, *Levees, Dikes, Flood protection, Seepage, Canals, Drainage, Drainage systems, Pumping, Cities, Contracts, Natural flow doctrine, Obstruction to flow, Alteration of flow, Relative rights, Judicial decisions, Legal aspects, Use rates, Overlying proprietor.

Plaintiff plantation owner sought to enjoin defendant plantation owner from maintaining a levee which prevented drainage from plaintiff's land. Plaintiff claimed a drainage servitude across defendant's land. Defendant's property was low, and excess water from the surrounding areas drained into it. Defendant's predecessor had reclaimed this tract by digging canals and erecting levees around the entire perimeter of his property. Defendant's predecessor agreed to accept drainage from the surrounding areas for a fee. This contract continued in force for several years until plaintiff declined to renew the agreement. Plaintiff then pumped his excess water into a canal until the municipality dammed the canal. Plaintiff then brought this action. Defendant asserted that plaintiff had abandoned the original servitude. Sustaining this assertion, the court refused the injunction and affirmed the judgment of the lower court for defendant. (Hart-Florida)
W71-01536

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,
John C. Ohrenschall, and Edgar A. Imhoff.
5 Land and Water L Rev 259-292 (1970). 33 p, 144 ref.

Descriptors: *Environmental effects, *Water utilization, *Riparian rights, *Prior appropriation, Preferences (Water rights), Beneficial use, Social aspects, Conservation, Environment, Pollution abatement, Institutional constraints, Water supply, Water pollution, Legal aspects, Judicial decisions, Non-consumptive use, Reasonable use, Legislation, Public rights, Water law, Competing uses, Federal-state water rights conflicts.

The present water law doctrines of riparian rights and prior appropriation impede rather than further the attainment of environmental enhancement goals. Increasing population and accelerated deterioration of the environment make a reshaping of these doctrines necessary. The traditional interpretations of the two doctrines arose in an era of environmental exploitation which must give way to environmental enhancement. The 'beneficial use' standard must be re-interpreted in order to facilitate uses compatible with a quality environment. The necessity for actual diversion to establish a recognized use should be eliminated. Non-consumptive uses should generally be given higher priorities in case of conflicting uses than industrial or most other consumptive uses. The 'reasonable use' standard in water law ensures flexibility but instills insecurity in water rights. Greater public control in the form of state or interstate commissions are needed to fully develop a water law system oriented toward environmental enhancement. (Caldwell-Florida)
W71-01547

THE PUBLIC TRUST IN TIDAL AREAS: A SOMETIME SUBMERGED TRADITIONAL DOCTRINE.
79 Yale L J 762-789 (1970). 26 p, 128 ref.

Descriptors: *Public rights, *Competing uses, *Economics, *Intertidal areas, Cost-benefit analysis, Tidal waters, Legal aspects, Judicial decisions, Easements, Land tenure, Public lands, Demand, State jurisdiction, Shores, Relative rights, Prescriptive rights, Priorities, Navigation, Access routes, Recreation, Remedies, History.

Due to the increasing demands upon tiday areas, the number of conflicting interests in these areas also increases. It is necessary to insure the wides possible and most effective utilization of tidal areas. In Roman law, all of the shore and tidal areas were under common ownership. In medieval times, however, the shores often came to be considered the personal proerty of feudal princes. Beginning with the Magna Charta, there has been a gradual trend toward increased public rights in tidal areas. These rights have often been expressed in terms of easements or of prescriptive public rights. Vastly increased demands upon the resources of tidal areas are running far ahead of the protections afforded public interests. Modern 'public trust' theory utilizes both easements and prescriptive rights. It also recognizes several categories of public interests which should be protected in and of themselves, including navigation, ports and recreation. These often competing uses have been afforded different priorities at different times, with navigation generally given the most absolute protection. (Caldwell-Florida)
W71-01548

WATER LAW IN SOUTHEASTERN WISCONSIN.
Wisconsin Univ., Madison.

Southeastern Wisconsin Regional Planning Commission, Technical Report Number 2, (1966). 92 p, 169 ref.

Descriptors: *Wisconsin, *Governments, *Watershed management, *Water law, Water pollution, Water pollution control, Legal aspects, State governments, Local governments, Administration, Management, Flood routing, Water resources development, Water management (Applied), Planning, Watersheds (Basins), Regions, Surface waters, Rivers, Flood control, Groundwater, Area development, Institutions, Legislation, Water policy.

The study is divided into segments: (1) riparian and public rights law; (2) groundwater law; and (3) diffused surface water law. Each segment is first dealt with generally, followed by surveys of more complex problems involving one or more segments of the field. Riparian and non-riparian use of water are discussed, along with the concept of navigability. Groundwater law and diffused surface water law are treated in a more cursory fashion. Flood plain regulations in general and those of Wisconsin in particular are examined. Pollution and pollution control are discussed from the public and private standpoints. Watershed management is studied, with particular emphasis on the Root River watershed and the organization of local governments to manage whole watersheds. Maps of the southeastern Wisconsin region and the Root River watershed are included, as are copies of Wisconsin statutes affecting water law and a model floodway encroachment act. (See also W71-01550 and W71-01551). Dye-Florida)
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (RIPARIAN AND DIFFUSED SURFACE WATER LAW).
Wisconsin Univ., Madison.

Southeastern Wisconsin Regional Planning Commission, Technical Report Number 2, p 1-40 (1966).

Descriptors: *Water law, *Wisconsin, *Governments, *Watershed management, Local governments, Administration, Management, Flood routing, Water resources development, Water management (Applied), Planning, Watersheds (Basins), Surface waters, Flood control, Groundwater, Area development, Legislation, Water policy, Flood plain zoning, Floods, Natural flow doctrine, Reasonable use, Navigable waters, Legal aspects, State governments.

The three principal divisions of water law: riparian and public rights law, groundwater law and diffused surface water law, are discussed with regard to the historical and substantive reasons for such catagorization. Riparian and public rights to the use of water including riparian doctrine, the natural flow doctrine, the reasonable use doctrine and the concept of navigability are explored. Augmentation of common law riparian doctrine by legislation is examined briefly. The law governing use of subsurface and diffused surface water is given brief treatment. Diffused surface water law is treated from the private and public standpoints as to discharge and drainage. Common law and statutory regulation of flood plains are discussed, with emphasis on suggested patterns of regulation. (See also W71-01549). (Dye-Florida)
W71-01550

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).
Wisconsin Univ., Madison.

Southeastern Wisconsin Regional Planning Commission, Technical Report Number 2, (1966), p 41-92.

Descriptors: *Wisconsin, *Floods, *Water resources development, *Water pollution control, Water pollution, Flood protection, Flood plain zoning, Governments, Watershed management, Water law, Legal aspects, Legislation, State governments, Federal government, Administration, Management, Surface waters, Flood control, Area development, Institutions, Water policy, Diversion, Drainage districts, Public rights, Relative rights.

Constitutional and statutory authority for regulation of flood plain zoning and construction by the Wisconsin Industrial Commission are treated briefly. Federal, state, local and private interests and authority in pollution control are discussed in the context of the administrative machinery available in Wisconsin for pollution control. The role of drainage districts in flood control and the remedies available to districts against private owners backing floodwaters into drainage districts are discussed. The Root River watershed is examined, as are the legal aspects of interbasin water diversion. The implications of watershed development and local construction of water development facilities are examined. Conclusions and recommendations are followed by maps of southeastern Wisconsin and the Root River watershed and appendices of water law related statutes. (Dye-Florida)
W71-01551

AN ACT RELATING TO ENFORCEMENT BY SEA AND SHORE FISHERIES AND THE MAINE MINING BUREAU.
Maine Pub Laws ch. 535 (1970) (amending Rev Stat 10.2155, 12.3752.6).

Descriptors: *Maine, *Fisheries, *Administration *Adjudication procedure, Permits, Legal aspects Commercial fishing, Administrative agencies, Mining, Regulation, Administrative decisions, Supervisory control (Power), Water pollution control Oil.

The Commissioner of Sea and Shore Fisheries is given broad licensing power in connection with commercial fishing in the state. Such licenses may be suspended by the Commissioner for violations of statutes or regulations, or for other causes. Procedures are established whereby a perso

vhose license has been suspended may petition for einstatement. A hearing must be held on the equest, after which the license may be reinstated if he Commissioner is satisfied that such action vould be in the interest of justice. The Mining Bu- eau is given broad powers to prevent waste of oil nd gas and resultant pollution, and to make regu- ations, issue permits and collect fees in exercise of nese powers. (Caldwell-Florida)
V71-01552

OLLUTION ABATEMENT FACILITIES-- RANTS AND LOANS FOR PRELIMINARY LANNING.
Iaine Pub Laws, ch 546 (1970) (amending Rev tat 38.412).

escriptors: *Maine, *Pollution abatement, Grants, *Treatment facilities, Local governments, overnment finance, Planning, Construction, egal aspects, Project planning, Costs, Cities, Ad- inistrative agencies, Financing, Sewers, Legisla- on, Estimated costs, Surveys, Civil engineering, opulation, Non-structural alternatives.

he Water Improvement Commission of Maine is ven specific guidelines in this amending statute r making pollution-abatement grants to local overnments and planning agencies. The super- ded section provided that the Commission was uthorized to pay up to 50 per cent or $2500, hichever was less, of sewage surveys. The instant ection expands the grant-making power to include d to all types of planning for pollution treatment cilities and sets up population brackets whereby ore populous areas get more money. Grants are uthorized for analyses of existing problems, area udies, cost estimates, and preliminary sketches of cilities. No grants can be made for areas having een the subject of a prior study within 5 years, nor r any costs incurred after the town or planning gency has voted to undertake the project. Non-in- erest bearing loans are also authorized. The funds r such grants and loans are to come from roceeds from bond issues. (Caldwell-Florida)
V71-01553

N ACT RELATING TO PERMITS FOR REDGING AND ERECTION OF CAUSEWAYS, OCKS, ETC. IN TRIBUTARIES OF GREAT ONDS.
Iaine Pub Laws ch 551 (1970) (amending Rev tat 12.514).

escriptors: *Maine, *Great ponds, *Permits, Dredging, Tributaries, Streams, Administrative gencies, Bodies of water, Legal aspects, Regula- on, Ponds, Riparian land, Riparian rights, Surface aters, Landfills, Marinas, Legislation.

his act amends the statute dealing with the protec- on of great ponds. Permits must be obtained for ny dredging in tributary rivers or streams of great onds, as well as in the great ponds themselves. The otice-giving procedures in the issuance of permits e amended. Tributary rivers or streams of great onds are added as a category of waterbodies overed by the statute. Great ponds are redefined include not only inland fresh water bodies having natural surface area greater than 10 acres, but lso any waterbody which is artificial or increased om natural size, is larger than 30 acres and whose ore is owned by two or more persons. (Caldwell- lorida)
V71-01554

VATERS-POLLUTION-DISCHARGE LICENSE.
Iaine Pub Laws ch. 567 (1970) (amending Rev tat 38.414).

escriptors: *Maine, *Waste disposal, *Regula- on, *Permits, Administrative agencies, Water pol- ution control, Standards, State governments, Con- ol, Legislation, Legal aspects, Administrative ecisions, Supervisory control (Power), Wastes.

The Water Improvement Commission has the power to issue waste discharge licenses. These licenses may be issued after a hearing by not less than three members of the Commission, and any issuance thereupon is deemed to be action by the full Commission. Evidence to be considered by the Commission at such a hearing shall include, but not be limited to, the applicant's financial ability to meet state water pollution control standards. (Caldwell-Florida)
W71-01555

OIL DISCHARGE PREVENTION AND POLLUTION CONTROL.
Maine Pub Laws ch. 572 (1970) (amending Rev Stat 38.416, adding 38.3.541 - .557).

Descriptors: *Maine, *Oil, *Water pollution control, *Coasts, Water utilization, Land use, Recreation, Commercial fishing, Legislation, Regulation, Transportation, Public rights, Legal aspects, State jurisdiction, Administrative agencies, Facilities, Oil industry, Permits, Adjudication procedure, Disasters, Treatment, Government finance, Damages, Tidal waters.
Identifiers: *Oil spills.

The Maine Environmental Improvement Commission is given broad powers in regulating oil transportation and dealing with violations of its regulations. The Commission licenses oil terminal facilities, and regulates vessel operative and inspection requirements, discharge reporting procedures, and pollution removal procedures, among other areas. The Governor is given broad emergency powers in case of disasters involving major oil spills. Violations of the act or Commission regulations is made punishable by a fine of up to $5000 per day. The Maine Coastal Protection Fund is set up for the purposes of research and development, reimbursing third parties damaged by oil pollution and funding Commission activities, including oil removal costs. Polluters must either remove pollution themselves or reimburse the fund for Commission costs. Coastal areas, being covered by the above act, are removed from the scope of Section 38.416, which deals with discharges into inland waters. (Caldwell-Florida)
W71-01556

THE TUNABOAT DISPUTE AND THE INTERNATIONAL LAW OF FISHERIES.

6 Calif Western L Rev 114-133 (1969). 19 p, 85 ref.

Descriptors: *International law, *Commercial fishing, *International waters, *Fisheries, Oceans, Boats, Foreign countries, Continental margin, Relative rights, Law of the sea, Resource allocation, Economics, International commissions, Legislation, Foreign waters, Treaties, Legal aspects, Political aspects, Conservation, Adjudication procedure, Fishing, Jurisdiction, Federal government, United Nations.

Seizures of U.S. tunaboats by several South American countries raise important issues for international law. The United States claims exclusive jurisdiction over ocean waters to a distance of three miles, reserving certain fishing priorities for a further distance. Some nations, however, claim exclusive fishing rights out to a distance of 200 miles, which rights are not recognized by the United States. International conventions have failed to resolve the dispute, and this has aggravated political tensions. The author contends that the roots of the conflict go beyond the superficial legal principles of 'freedom of the seas' and 'inherent rights'. Different needs in protecting commercial development of each country and the difficulty in reaching agreement as to allocation of the fish resources of the sea are bases for the dispute. The author suggests that ownership, or at least management, of the living resources of the sea be vested in an international agency, most likely the United Nations. This would provide needed control over resource allocation and provide the United Nations with needed funds through fees for use of these resources. (Caldwell-Florida)
W71-01557

AN ACT RELATING TO WATER QUALITY STANDARDS.
Maine Pub Laws ch 581 (1970) (amending Rev Stat 38.364, adding 12.2108).

Descriptors: *Maine, *Spawning, *Water quality control, *Classification, Tidal waters, Fish management, Administrative agencies, Adjudication procedure, Fish reproduction, Fish conservation, Bacteria, Coliforms, Standards, Water quality, Water utilization, Recreation.

The Commissioner of Inland Fisheries and Game is given the power to designate certain waters as fish spawning grounds. The Commissioner may take such action on his own initiative or upon request of any state agency. Provisions are made for notice, a public hearing and a record to be made of such hearing. If, after weighing the evidence presented at the hearing, the Commissioner determines that the area concerned should be protected, he may issue an order designating the area as a fish a fish spawning ground. Specific water quality standards are set forth. (Caldwell-Florida)
W71-01558

REPORT ON MAINE LAW AFFECTING MARINE RESOURCES.
Report on Maine Law Affecting Marine Resources, vol 2, p 157-417, 1970. Append.

Descriptors: *Maine, *Marine geology, *Sea water, *Coasts, Coastal engineering, Legal aspects, Judicial decisions, Boundaries (Property), Continental shelf, Law of the Sea, Bays, Erosion, Accretion (Legal aspects), Banks, Fishing, Riparian rights, Tidal waters, Legislation, Land reclamation, Eminent domain, Natural resources, Conservation, Cities, Parks, Public utilities.

This report places emphasis on Maine law and its responsiveness to the problems caused by the exploitation of marine resources. To allow a better perspective of these problems, basic principles of land law affecting marine resources are catalogued. One such problem is the placement of marine boundaries. Sub-problems dealing with marine boundaries include but are not limited to: the extent of Maine's territorial waters; the jurisdictional boundaries of state agencies in Maine's waters; and the demarcation of private versus public ownership on the land-sea interface. The report examines boundary problems relating to riparian lands, with a thorough analysis given to public and private rights in the seashore and tidal waters. Constitutional and statutory restrictions are examined as to their effect on the acquisition, disposal and regulation of public lands. The report also raises questions regarding the application of existing law to the problems of marine resources. Two questions are: (1) to what extent under current law may Maine's marine resources be privately owned and managed; and (2) exactly what is the state's power over submerged lands and territorial waters. Extensive efforts are made to answer these and similar questions. (Barnett-Florida)
W71-01559

LINCOLN COAL CO V DEATON (LIABILITY FOR EROSION CAUSED BY CHANGED RIVER CURRENT).
229 Ky 330, 17 SW2d 249-251 (1929).

Descriptors: *Kentucky, *Currents (Water), *Bank erosion, *Bridge construction, Riverflow, Legal aspects, Judicial decisions, Damages, Farms, Land, Rivers, Riparian land, Natural flow, Bridges, Piers, River beds, Flow, Diversion, Erosion, Accelerated erosion, Banks, Channel erosion.

Plaintiff farm owner sued defendant coal company for damage caused when part of plaintiff's land was washed away. The erosion was caused by a river current allegedly altered by defendant's construction of a bridge. Plaintiff claimed that the bridge pier in the middle of the river had caused the water to swirl against her land and that more than one acre had been washed away. Defendant contended the evidence did not support such a finding, that excessive rainfalls caused the damage and that no negligence was shown. The Court of Appeals of Kentucky, in affirming a lower court verdict for plaintiff, held that the jury chose between conflicting evidence, and there was no reason for the court to overturn the findings of fact. Moreover, once the jury found that defendant had diverted the flow of the river, it was not necessary to show negligence. (Morris-Florida)
W71-01560

THE 'RACE' FOR THE SEABED: THE RIGHT TO EMPLACE MILITARY INSTALLATIONS ON THE DEEP OCEAN FLOOR,
William A. Stoever.
4 Int Law 560-568 (1970). 8 p, 33 ref.

Descriptors: *International law, *Millitary aspects, *Oceans, *Beds, Exploitation, Continental shelf, Legal aspects, International waters, Relative rights, Political aspects, Jurisdiction, United Nations, Law of the sea, Foreign countries, Treaties, Organizations, Ownership of beds, Technology, International commissions, Electronic equipment.

The possibility of the emplacement of military installations on the ocean floor dictates that new doctrines of international law be developed in this area. The author argues that the status of the deep ocean floor is as yet undefined. Future definition will be worked out as a synthesis of competing pressures between expansion of undersea military activity, made possible by technology, and the increasing pressure for international agreement. A nation has exclusive rights in the continental shelf surrounding its coasts. How far national jurisdiction can be extended beyond the limits of exploitability of the shelf is a subject of much disagreement. The author argues that it is unlikely that the United States would unilaterally declare its intent to appropriate areas of the deep ocean floor. The United Nations has debated this question and appointed a commission to study the problem. Generally, less developed nations tend to be more favorably inclined toward an immediate international agreement limiting military exploitation of ocean beds than are nations whose technology would permit such exploitation. The author forsees a compromise which would ban offensive weapons but permit defensive electronic apparatus. (Caldwell-Florida)
W71-01561

LET THE POLLUTER BEWARE (LEGAL RAMIFICATIONS OF POLLUTION),
R. J. Farrell.
75 Case and Com 3-8 (1970).

Descriptors: *Air pollution, *Water pollution, *Legislation, *Legal aspects, Water pollution sources, Water pollution effects, Federal government, State governments, Water quality control, Damages, Remedies, Governments, Pollution abatement, Abatement, Water conservation, Oily water, Oil wastes, Oil industry, Oil, Oil wells, Regulation.

This article deals chiefly with problems of air pollution, with some attention to water pollution. Legal developments affecting both types of pollution are presented. Specific developments relating to water pollution such as the amendments to the Water Quality Act of 1965 which have been proposed to deal with offshore drilling, vessels, pollution disasters and removal of polluting substances and the Department of Interior's suggestions of absolute liability as a basis of recovery against oil companies whose drilling apparatus pollute water are examined. Legislative trends including: (1) extension of federal jurisdiction in the pollution area; (2) increased penalties; and (3) advancement of abatement timetables are discussed. That the federal government may enter the field with tax incentives to control pollution out, as are developing changes in tort concepts to facilitate recovery for pollution damage outside the existing concept of nuisance. (Dye-Florida)
W71-01562

HEWITT V PERRY (REASONABLE USE OF RECREATIONAL EASEMENT).
39 NE2d 575-576 (1942).

Descriptors: *Massachusetts, *Easements, *Usufructuary right, *Reasonable use, Navigable waters, Beaches, Recreation, Swimming, Fishing, Boating, Legal aspects, Judicial decisions, Relative rights.

Plaintiff sought an injunction to compel removal of defendant's bulkhead and to restrain defendant from building a new bulkhead. Defendant counterclaimed seeking to restrain plaintiff from using the beach area in dispute as a mooring ground or in any way for maintenance of her commercial business of letting boats. Plaintiff had been granted an easement to use the beach for bathing, boating, fishing and other recreation but had been using it for commercial business. In the lower court plaintiff was enjoined from such use. The Supreme Judicial Court of Massachusetts affirmed. Plaintiff's easement was general and unrestricted in nature, but plaintiff's commercial use was not a reasonable use and as such surcharged the easement granted. (Duss-Florida)
W71-01563

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (LICENSING OF POWER COMPANIES).
289 NY 353, 45 NE2d 907-908 (1942).

Descriptors: *New York, *Administrative agencies, *Water utilization, *Navigable waters, Permits, Legal aspects, Judicial decisions, Rivers, Diversion, Hydroelectric power, State governments, Legislation, Regulation, Adjudication procedure, Water supply.

Plaintiff New York Water Power and Control Commission sought a declaratory judgment and an injunction to prevent defendant power company from using water from the Niagara River because of defendant's refusal to apply for a license and pay rental for use of the water. The trial court dismissed the complaint for injunctive relief upon the merits, but enumerated certain rights of the parties. The appellate division reversed the declaratory judgment and modified it to read that the complaint was dismissed on the merits. Both parties appealed. The Court of Appeals of New York affirmed on the sole ground that defendant was exempted from state licensing requirements by state statute. Because the statute excluded defendant, and because the state itself was not a party to the litigation, there was no grounds for granting a declaratory judgment. (Duss-Florida)
W71-01564

AIR AND WATER POLLUTION,
Gerald Leinwand.
Air and Water Pollution (1969). 160 p, 1 illus, 40 photo, 2 dwg, 1 chart, 19 ref.

Descriptors: *Water pollution, *Water pollution sources, *Water pollution effects, *Air pollution, Dispersion, Environmental sanitation, Pollution abatement, Pollutant identification, Pollutants, Public health, Cities, Municipal wastes, Industrial wastes, Wastes, Water pollution treatment, Water quality, Water resources, Air pollution effects, Effluents, Environmental engineering, Fallout, Radioactive wastes, Waste disposal, Waste treatment.

Part one is a general presentation by the editors of the problems and challenges of air and water pollution. The history of pollution and several historical examples of it are sketched, followed by superficial assessments of the costs of pollution and the potential costs of alleviating it. The causes of pollution are discussed, along with suggestions as to what individuals, industry, cities, states and the federal government can do to attack the sources or decrease the effects of pollution. Following this introduction are fifteen short articles by assorted authors, five of which deal with water pollution. The articles explore pollution by municipal and industrial wastes, pesticides and other chemicals, detergents, and radioactivity. Forty-three photographs, illustrations and charts complement the textual material and a bibliography of suggested readings in the pollution area is included. (Dye-Florida)
W71-01565

THE WATER CRISIS,
Frank E. Moss.
The Water Crisis (1968). 319 p, 17 map, 2 illus, 1 dwg, 1 chart.

Descriptors: *Water resources development, *Water pollution, *Impaired water quality, *Water supply, Water quality control, Water utilization, Water pollution sources, Water pollution effects, Water pollution treatment, Pollution abatement, Legal aspects, Legislation, Administrative agencies, Planning, Multiple-purposes projects, Water policy, Federal government, Water management (Applied), Public rights, River basin development, Interstate commissions, Weather modification, Desalination, Social aspects.

Water resources in the United States are in a state of worsening crisis. The quantity of available water is fixed and may soon become inadequate to serve the needs of the exploding population. Pollution has resulted in serious deterioration of water quality in all areas of the country. From this premise, the author discusses problems of obtaining maximum use of groundwater resources, destruction of land resources by mining and other industries, flood prevention and preservation of recreation areas. Several examples of attempts to deal with the water crisis are cited. The author points to efforts of soil and forest conservation, desalination projects, treatment and re-use of polluted water, research projects, and efforts to divert water resources from well-watered to dry regions. The author concludes that the crisis can only be alleviated by cooperation between all levels of government. A comprehensive national water policy, administered by a National Water Commission, is necessary to coordinate efforts to solve water problems and to direct a national program toward these ends. (Caldwell-Florida)
W71-01566

MAIER V PUBLICKER COMMERCIAL ALCOHOL CO (LIABILITY FOR POLLUTION AS PRIVATE NUISANCE).
62 F Supp 161-168 (ED Pa 1945).

Descriptors: *Pennsylvania, *Rivers and Harbors Act, *Admiralty, *Delaware River, Solid wastes, Legal aspects, Judicial decisions, Remedies, Damages, Wastes, Salvage value, Ships, Navigable rivers, Navigation, Regulations, Water pollution.
Identifiers: *Private nuisance.

Libelant salvage company sued respondent manufacturer for damages to meet the increased cost of raising a partially sunken vessel in the Delaware River. Libelant alleged that respondent discharged grain residue into the river in violation of the Rivers and Harbors Appropriation Act of 1899 and that the grain filled the holds of the vessel, thus making the vessel more difficult to raise. The court held that violation of criminal statute did not by itself constitute negligence and that a lack of due care had not been proven. However, the court ruled that libelant could recover on the basis of a private nuisance since the results were foreseeable and

preventable, and thus intentional. The court held further that the fact that libelant also may have been in violation of the Rivers and Harbors Act for obstructing navigable waters would not be a defense available to respondent. Libelant's violation may have been a condition precedent to the injury, but it was not the cause. (Morris-Florida)
W71-01567

BOWERS V PRICE (LIABILITY FOR INCREASE OF NATURAL FLOW BY DOMINANT ESTATE).

56 Pa D and C 256-263 (1944).

Descriptors: *Pennsylvania, *Surface runoff, *Natural flow, *Reasonable use, Boundaries (Property), Legal aspects, Judicial decisions, Surface drainage, Storm runoff, Topography, Paving, Roofs, Damages, Rain water, Drains, Riddance (Legal aspects), Relative rights, Overlying proprietor.

Plaintiffs sought an injunction against defendant to prevent him from causing rain water to drain into plaintiffs' cellar. Plaintiffs also sought damages for injury allegedly caused by defendant's construction of a sidewalk bordering his property and a gabled roof over a garage. Plaintiffs alleged the construction caused water to drain onto his property in greater quantities than it had previously. Defendant denied liability, claiming any improvements to his property were wholly within his rights. The court held that defendant was the dominant tenement and as such had an easement over the lower servient tenement of plaintiffs as long as he did not construct an artificial channel to concentrate the drainage. The court said Pennsylvania follows the rule that every person may ke reasonable use of his own land and any damage such use causes is damage without injury. (Morris-Florida)
W71-01568

DOLL V BLITZ (RIGHT TO REASONABLE DOMESTIC USE OF SPRINGWATER).
1 Monroe L R 184-191 (Pa Eq 1939).

Descriptors: *Pennsylvania, *Water demand, *Pipelines, *Spring waters, Mineral water, Subsurface waters, Beneficial use, Consumptive use, Water allocation (Policy), Judicial decisions, Legal aspects, Domestic water, Water distribution (Applied), Equitable apportionment, Piping systems, Relative rights, Water users, Usufructuary right.

Plaintiff grantee sought to enjoin defendant grantee from piping water from a commonly owned spring to his barn and house. Plaintiff contended that the deed from defendant grantor to her limited the use of the spring water to those uses existing at the time of the delivery of the deed. Defendant grantor contended that the provisions of the deed established only that both parties were to retain equal rights to use the spring water for domestic uses and that no limitations were imposed as to specific existing uses. The court, in denying the injunction, held that the deed established only equal rights to water for domestic use and imposed no limitations as to specific uses at the time of the deed. (Quesada-Florida)
W71-01569

REGULATION OF POLLUTION BY MINE WASTES.
Pa Stat Ann tit 35, secs 691.311, thru 691.317 (1964), as amended, (Supp 1969).

Descriptors: *Pennsylvania, *Acid mine water, *Diversion, *Water pollution control, Regulation, Legislation, Legal aspects, Administrative agencies, Eminent domain, Condemnation, Easements, Mine water, Industrial wastes, Coal mine wastes, Costs, Pollution abatement, Water pollution sources, Waste disposal, Right-of-way, Waste water disposal, Mining.
Identifiers: Penalties (Civil).

The Sanitary Water Board is empowered to acquire, by condemnation or purchase, such easements of rights-of-way as are necessary to prevent the pollution by acid mine drainage of 'clean waters' by diverting such drainage into polluted or unclean waters. The state shall pay the cost of acquiring such easements and of such equipment as may be necessary to divert the acid mine drainage. The condemnation procedure is set forth. A plan for the disposal of acid mine drainage must be submitted by all coal mining operations to the Sanitary Water Board for approval. Failure to submit such a plan is punishable by fine and/or imprisonment. Any corporation that has been ordered by the Board to cease discharging industrial waste into waters of the state when such order materially affects the operations of that corporations' business may apply to the Board for an order that recognizes the applicant's special interest in a specific piece of land that is necessary for the elimination of the corporation's pollution of the state's waters. Such an order vests in the corporation the right of eminent domain. (Sisserson-Florida)
W71-01570

UNITED STATES V 25.88 ACRES OF LAND (TITLE TO UNDERWATER LAND).

49 F Supp 250-257 (ED NY 1943).

Descriptors: *New York, *United States, *Ownership of beds, *Condemnation, Land tenure, Eminent domain, Legislation, Docks, Bulkheads, Bulkhead line, Piers, Land forming, Riparian land, Governments, Grants Patents, Public rights, Judicial decisions, Legal aspects, State governments, Beds under water.

In a condemnation proceeding by the United States, the state of New York challenged the title of the defendant, who was the alleged owner of the land in question. Defendant claimed title through state patents to his ancestor. The state argued that land under water was held in trust for all the citizens of the state and that the state could not divest itself of title to such property. The state further claimed that the land was no longer being used pursuant to the original grants and that title therefore had reverted to the state. Citing a long line of similar cases, the United States District Court, Eastern District of New York, ruled that title had properly been granted to defendant's predecessor and that the land had not reverted to New York through abandonment of the original purpose of the patents. (Barker-Florida)
W71-01571

STATE V HELLER (RIPARIAN OWNER'S RIGHT TO BATH IN MUNICIPAL WATER SUPPLY).
123 Conn 492, 196 A 337-343 (1937).

Descriptors: *Connecticut, *Riparian rights, *Swimming, *Municipal water, Relative rights, Reasonable use, Streams, Non-consumptive use, Water pollution, Recreation, Eminent domain, Legislation, Water pollution control, Public health, Environmental sanitation, Social aspects, Water quality, Riparian waters, Judicial decisions, Legal aspects, Governments, Remedies, Water quality control, Water supply.
Identifiers: *Police power.

Defendant landowner was arrested for bathing in a stream which ran through his land and which was tributary of a municipal reservoir. Defendant claimed that the statute which prohibited bathing in tributaries of public water supplies was an interference with his riparian rights. He further contended that such an interference constituted a compensable taking of property by the state. The state argued that the statute was a reasonable exercise of its police powers in an attempt to protect public health. The Supreme Court of Errors of Connecicut, in affirming defendant's conviction, ruled that even though a riparian owner has a right to ordinary and reasonable bathing, public health protection may require such right to be curtailed. Such a curtailment is not an exercise of eminent domain for which compensation is required, but merely a valid exercise of the state's police powers. (Barker-Florida)
W71-01572

UNITED STATES V BIG BEND TRANSIT CO (TITLE TO CONDEMMED LAND ON INDIAN RESERVATION).

42 F Supp 459-475 (ED Wash 1941).

Descriptors: *United States, *Land tenure, *Condemnation, *Administrative decisions, Administrative agencies, Federal government, Permits, Prior appropriation, Water rights, Legislation, Federal Power Act, Dams, Damsites, Indian reservations, Judicial decisions, Legal aspects, Eminent domain, Condemnation value.

In order to construct the Grand Coulee Dam, the United States condemned certain tracts of land on the Spokane River. The river formed the southern boundary of the Spokane Indian Reserviation, and one of the condemned tracts was located on the reservation. Defendant transit company claimed title to this tract on the basis of an earlier approval by the Secretary of Interior of defendant's application for the acquistion of such land for use as a power dam site. Plaintiff claimed that such approval was insufficient to convey an interest in the land, that any interest which defendant might have acquired had since reverted to the government because of defendant's delay in constructing a dam, and that any interest defendant might have had was repealed by the Federal Power Act of 1920. The United States District Court, Eastern District of Washington, rejected all of plaintiff's arguments and ruled that defendant had a valid interest in the condemned tract. The question of the value of the interest was to be submitted to a jury. (Barker-Florida)
W71-01573

LAW OF THE SEA--THE CONTINENTAL SHELF--UNITED STATES PROPRIETARY CLAIM TO THE CONTINENTAL SHELF GIVES RISE TO A NEW PUBLIC DOMAIN,
Gregory M. Lattimer.
5 Land and Water L Rev 509-516 (1970). 8 p, 33 ref.

Descriptors: *United States, *Continental shelf, *Reefs, *Ownership of beds, Natural resources, Water resources, Coral, Submerged Lands Act, Tidal waters, Oceans, Water law, Law of the sea, Governments, Federal government, Legislation, Atlantic Ocean, International law, Treaties, International waters, Dredging, Landfills, Islands, Judicial decisions, Florida, Legal aspects.

This case note traces the law of international waters as it has developed in the United States from the Truman Proclamation to the case of United States v Ray, 294 F. Supp. 532 (S.D.Fla. 1969). After outlining the development of three ocean zones, the three-mile territorial zone, the high-seas zone, and the nine-mile buffer zone, the note discusses the authority of nations over the subsurface of ocean bottom, and the effects of the Submerged Lands Act and the Continental Shelf Act. The note then discusses the reasoning and probable effects on international law of the instant case, in which two developers contended they were free to develop certain reefs outside the three-mile limit of the United States. For policy reasons the court had held that the reefs were natural resources rather than islands, thereby subjecting them to government regulation. (Liptak-Florida)
W71-01574

WHAT CONSTITUTES A VIOLATION OF THE PROHIBITION, IN THE OIL POLLUTION ACT OF 1924 (33 USC 431 ET SEQ), OF DISCHARGE OF OIL INTO NAVIGABLE WATERS AND ADJOINING SHORELINES,
J. F. Ghent.

Annot, 2 ALR Fed 794-802 (1969). 9 p, 18 ref.

Descriptors: *Water pollution control, *Legislation, *Oil, *Ships, Water pollution, Water pollution sources, Pollution abatement, Oily water, Admiralty, Navigation, Navigable waters, Transportation, Federal government, Legal aspects, Judicial decisions, Regulation, Oil wastes, Water quality control.
Identifiers: *Oil Pollution Act.

This annotation collects and analyzes ten cases in which the courts have developed the criteria for determining whether a discharge of oil into United States' navigable waters is a violation of the Oil Pollution Act of 1924. After reproducing the text of the Act, the annotation discusses the three general rules that have emerged from the cases. First, the Act prohibits any avoidable oil discharge, the amount of oil not being the test of guilt. Second, even unintentional discharges are prohibited unless they result from an unavoidable accident or collision. Finally, the defense of 'unavoidable accident' is available only in the absence of negligence. (Liptak-Florida)
W71-01575

GARLAND LEVEE DIST V HUTT (LEVEE DISTRICT'S LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF LEVEE).

183 SW2d 296-298 (Ark 1944).

Descriptors: *Arkansas, *Flood damage, *Levees, *Condemnation value, Water injury, Flooding, Rivers, Legislation, Legal aspects, Judicial decisions, Adjudication procedure, Easements, Right-of-way, Eminent domain, Condemnation, Compensation, Remedies, Damages, Flood control, Flood protection, River regulation, Shore protection, Flood water, Administrative agencies.
Identifiers: *Levee districts.

Plaintiff landowners brought suit against defendant levee district to recover damages for a taking of land for the construction of a new levee. Plaintiffs contended that they were entitled to the value of the land left between the old and new levees (as a basin to absorb flood waters) as well as the value of the land actually used for levee construction. Defendant argued that the choice of location for the levee was a discretionary decision, not subject to review by the court, and that compensation was only necessary for the land actually taken. Modifying a judgement for plaintiffs, the court held that, although the selection of the new levee's location was not subject to review, plaintiffs were entitled to recover for the imposition of a flood easement upon their land. (Liptak-Florida)
W71-01576

LEITCH V SANITARY DIST OF CHICAGO (RIPARIAN RIGHT TO UNOBSTRUCTED FLOW OF RIVER).

369 Ill 469, 17 NE2d 34-37 (1938).

Descriptors: *Illinois, *Riparian rights, *Natural flow, *Obstruction to flow, Navigable river, Sewers, Bridges, Navigable waters, Streams, Natural flow doctrine, Riparian land, Judicial decisions, Cities, Legal aspects, Water law, Water districts, Alteration of flow, Appropriation, Eminent domain, Condemnation, Riparian waters, Adjudication procedure.

Plaintiff riparian owners sued to enjoin defendant city sanitary district from obstructing the flow of a navigable stream by the construction of a sewer and a bridge. Plaintiffs contended that the filling in of the channel for the construction would interfere with their right to the natural flow of the stream and that such a right was property which could not be destroyed without just compensation. Reversing an order dismissing the complaint, the court stated that the facts alleged clearly showed that plaintiffs were riparian owners, were entitled to the unobstructed flow of natural streams, and that defendant could only acquire those riparian rights by the exercise of its eminent domain powers. (Liptak-Florida)
W71-01577

I. COMPREHENSIVE PLAN FOR THE FOX RIVER WATERSHED, CH 14 (SURVEY OF LEGAL ASPECTS OF WATERSHED DEVELOPMENT).
Southeastern Wisconsin Regional Planning Comm, Planning Report No 12, Vol 1, ch 14 (1969). 24 p, 52 ref.

Descriptors: *Wisconsin, *Watershed management, *Water resources development, *Water law, Flood control, Water management (Applied), Watersheds (Basins), Water quality control, Water pollution control, Governments, Cities, Local governments, State governments, Sewage districts, Water pollution sources, Sewage disposal, Drainage districts, Drainage proctices, Surface water, Surface runoff, Groundwater, Riparian rights, Legal aspects, Planning.

A legal study of Wisconsin water law begins with: a general summary of water law; the classifications of water into surface, diffused, ground, percolating, and spring water; and riparian and non-riparian rights to the use of water. Floodland regulation is discussed by defining flood channel, floodway, and flood plains, and discussing the regulatory means available at the state and local levels--including zoning, subdivision regulation, and building codes. Pollution control is discussed and the regulatory measures used by federal, state, and local governments are outlined, as well as potential enforcement by private actions. The study then outlines the legislative authority available to districts desiring to construct flood facilities. Finally, specific legal problems in the Fox River watershed are pointed out. These include backwater damage, boundary determination, diversions, and private dams which have become 'natural conditions' through long usage. (Liptak-Florida)
W71-01578

ROE V CITY OF MIDDLETOWN (MUNCIPALITY'S LIABILITY FOR DAMAGE RESULTING FROM FILLING OF CHANNEL).
262 App Div 231, 28 NYS2d 803-806 (1941).

Descriptors: *Channels, *New York, *Cities, *Obstruction to flow, Streamflow, Drains, Alteration of flow, Water fights, Judicial decisions, Legal aspects, Construction, Riparian rights, Public benefits, Barriers, Diversion, Remedies, Flooding, Cutoffs, Floodways, Ditches, Conduits, Local governments, Streams, Surface drainage, Water conveyance, Streambeds, Channel flow, Discharge (Water).

A stream, passing through plaintiff's premises, frequently overflowed, damaging plaintiff's buildings. Defendant city constructed a new channel for the stream under the street which paralleled the old channel and plaintiff's premises. Street drains emptied deposits into the old channel from the street. Defendant placed fill in the upstream portion of the old channel down to a bulkhead which was constructed on plaintiff's boundary line. Plaintiff brought an action for damages and permanent injunction to compel the removal of all fill from the old channel. Plaintiff alleged that defendant's acts caused water to collect on plaintiff's premises. Plaintiff also alleged that defendant unlawfully obstructed the flow of the stream. The Supreme Court of New York, in modifying a lower court's judgment for plaintiff, compelled defendant to restore and perpetually keep the old channel at its original flow level along plaintiff's premises. The court stated that defendant was liable for injuries to plaintiff's buildings resulting from filling of the old channel, and would be required to keep the old channel clean in the future where street drains emptied into it. (Powell-Florida)
W71-01579

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RECOVERY OF DAMAGES FOR CITY'S POLLUTION OF RIVER).
165 Misc 722, 1 NYS2d 589-595 (1938).

Descriptors: *New York, *Water pollution, *Riparian rights, *Sewage, Sewage disposal, Sewers, Legal aspects, Judicial decisions, Sands, Gravels, Cities, Riparian waters, Rivers, Navigable waters, Lake Erie, Permits, Dredging, Land, Land tenure, Local governments, Municipal wastes.
Identifiers: *Uplands.

Plaintiff riparian owner sought damages and injunctive relief against defendant municipality for pollution of the Niagara River adjacent to plaintiff's property. Plaintiff alleged destruction of sand and gravel deposits on its land under water, which it dredged for commercial purposes, and permanent damage to its uplands. Defendant argued that plaintiff could not recover because it held no federal license to dredge. The trial court gave judgment for defendant. The appellate division reversed and entered an interlocutory judgment for plaintiff. The Supreme Court affirmed the appellate division and assessed damages. The court stated that the right of plaintiff as a riparian owner to dredge its land is absolute, and that a federal license to dredge was not necessary. The court accepted the trial court's determination of plaintiff's ownership of lands under water and assessed the damages for destruction of the sand and gravel. It also determined damages to plaintiff's uplands, but found that the evidence did not show permanent damage. Since the construction of a new power project was in progress which would obviate pollution in the future, there was no reason to grant plaintiff injunctive relief. (Duss-Florida)
W71-01580

SEGARS V CITY OF CORNELIA (EASEMENT TO DISCHARGE SEWAGE).

4 SE2d 60-63 (Ga Ct App 1939).

Descriptors: *Georgia, *Easements, *Water pollution, *Water pollution sources, Riparian rights, Legal aspects, Judicial decisions, Streams, Riparian land, Real property, Air pollution, Wastes, Municipal wastes, Cities, Local governments, Impaired water quality, Path of pollutants, Pollution abatement, Water pollution effects, Domestic wastes, Sewage, Waste water disposal.

Defendant city discharged large amounts of sewage into a stream running through plaintiff's property. Plaintiff, who sought damages and injunctive relief from such discharge, offered testimony indicating that: (1) pollution of the stream resulted in serious contamination of springs and smaller streams on his property; (2) the shores of the stream were encrusted with noxious materials when the stream overflowed; (3) noxious odors resulted from the sewage; and (4) plaintiff's land was rendered unfit for residence or rental. Plaintiff contended that he was entitled as a riparian owner to pure water. Defendant contended that under a lost written agreement plaintiff's grantor had granted to the city the right to discharge sewage into the stream. On appeal from the trial court's judgment for defendant, plaintiff contended that parol evidence should not have been admitted to prove the contents of the lost agreement. The court, in affirming, ruled that the contents of a lost writing may be established by parol. Plaintiff took title to his land subject to an easement in defendant created by plaintiff's grantor. Plaintiff was bound by such easement even though he had no notice of it. (Dye-Florida)
W71-01581

G L WEBSTER CO V STEELMAN (ABATEMENT OF STREAM POLLUTION CAUSED BY CANNERY).
1 SE2d 305-316 (Va 1939).

Descriptors: *Virginia, *Water pollution effects, *Organic wastes, *Drainage water, Legal aspects,

udicial decisions, Damages, Tidal waters, Water ollution, Odor, Sediments, Sediment transport, Organic matter, Waste water disposal, Public ights, Ditches, Streams, Vegetable crops, Drainage, Navigable waters, Judicial decisions, egal aspects, Pollution abatement.
dentifiers: *Nuisance (Public).

laintiff sued for damages to his property caused by dor resulting from drainage from defendant's egetable canning plant. Fresh water used to clean aw vegetables at the plant was filtered to remove olid particles. After filtration, it flowed into a ditch nd then into a creek emptying into tidewaters bor- ering plaintiff's land. Alteration of the ditch to im- rove flow caused organic sediment from the filtra- on process to reach the tidelands, creating a tench at low tide and killing fish. In the lower ourt, plaintiff recovered on a nuisance basis, and he appellate court affirmed, finding that defendant lant, although large and important to the county, as not connected with a public interest. Thus de- endant did not have a public right to drain its efuse across plaintiff's land. Defendant was perating in a private capacity without special rivilege and thus had a responsibility not to injure thers. Further, the right to drainage did not in- lude the right to pollute. (Morris-Florida)
W71-01582

EGARS V CITY OF CORNELIA (CITY'S LIA- ILITY FOR WASTE POLLUTION OF TREAM).

93 SE 794-796 (Ga Ct App 1937).

Descriptors: *Georgia, *Municipal wastes, *Water ollution effects, *Remedies, Cattle, Legal aspects, udicial decisions, Damages, Water pollution, Wastes, Water sources, Springs, Local govern- ents, Streams, Odor, Riparian rights, Sewage, Crops, Corn (Field), Hay, Cities, Adjuciation rocedure.
dentifiers: *Nuisance.

laintiff farm owner sued for damages to his land, prings, cattle and crops allegedly caused by defen- ant city's depositing of sewage into a creek ad- acent to his land. As a result of the pollution, plain- ff's crops were unmerchantable, the cattle would o longer drink the water from the stream or prings, nor would they eat the crops, the air was efouled and plaintiff had to abandon his home. he court reversed a decision sustaining defen- ant's demurrer, finding that the complaint alleged cause of action for a continuing nuisance. The ourt stated that damages should also lie for the educed rental value of the property. (Morris- lorida)
W71-01583

NIGHT V ROGERS (TITLE DISPUTE TO CCRETIONS IN NAVIGABLE RIVER).

51 SW2d 669-672 (Ark 1941).

Descriptors: *Arkansas, *Accretion (Legal spects), *Boundary disputes, *Islands, Land enure, Real property, Boundaries (Property), Ju- icial decisions, Legal aspects, Riparian land, Land orming, Navigable rivers, Navigable waters, treams, Legislation, State governments, Bank ero- on, Ownership of beds.

n an action of ejectment, one of the grounds of laintiff's claim of title was that a state statute pro- ided that title to any land formed in navigable aters and within the original boundaries of a ormer owner of land on such a stream would vest n that former owner. As to that contention, the ourt held that the statute was intended to apply nly to the formation of islands, whereas the land in ispute was formed by accretion to defendant's roperty. (Liptak-Florida)
W71-01584

HUMPICH'S TRUSTEES V LOUISVILLE GAS AND ELEC CO (POWER COMPANY'S LIABILI- TY FOR BACKWATER FLOODING CAUSED BY FEDERAL DAM PROJECT).
269 Ky 558, 108 SW2d 509-511 (1937).

Descriptors: *Kentucky, *Flood damage, *Backwater, *Dams, Flooding, Water injury, Hydroelectric plants, Compensation, Eminent domain, Condemnation, Damages, Remedies, Judicial decisions, Federal government, United States, Legal aspects, Electric power, River regulation, Rivers, Ohio River, Riparian land.

Plaintiff landowner brought action against defendant power company to recover for flooding of plaintiff's property by the Ohio River. Such flooding resulted from the erection of a federal dam project. Plaintiff contended that defendant's power plant called for additional elevation of the dam and that this extra height caused the flooding of plaintiff's land. Defendant admitted the flooding but argued that the federal government was in complete control of the water level at all times and that defendant was in no way responsible for the flooding. Affirming a judgment for defendant, the court held that defendant was simply a licensee and that the federal government had complete control of, and therefore sole liability for, fluctuations in the water level above the dam. (Liptak-Florida)
W71-01585

TURK V WILSON'S HEIRS (TITLE DISPUTE TO ACCRETION FORMED IN MISSISSIPPI RIVER).
266 Ky 78, 98 SW2d 4-15 (1936).

Descriptors: *Accretion (Legal aspects), *Boundaries (Property), *Islands, *Kentucky, Mississippi River, Real property, Judicial decisions, Boundary disputes, Legal aspects, Ownership of beds, Land tenure, Prescriptive rights, Navigable rivers, Governments, State governments, Erosion, Land forming, Grants, Overlying proprietors, Beds under water.

Plaintiff landowners sued defendant landowners to recover property which was in defendant's allegedly wrongful possession. Plaintiffs' ancestor had acquired an island in the Mississippi River by patent and claimed title to substantial accretions which had since formed additions to the island. Plaintiffs argued that the original patent conveyed title to the river bed to midstream, and therefore when part of that bed became high and dry, title was vested in the upland owner. Defendants claimed title by junior patents from the state and also claimed adverse possession, arguing that actual adverse possession of part of the accreted land implied constructive adverse possession of the whole. Affirming a judgment for plaintiffs, the court held that title to accretions normally vests in the upland owner, especially when his patent conveys title to midstream. (Liptak-Florida)
W71-01586

ADAMS V ELLIOTT (RIPARIAN OWNER'S LIABILITY FOR INJURIES ARISING OUT OF AUTO COLLISION WITH IMPROPERLY LIGHTED PIER).
174 So 731-736 (Fla 1937).

Descriptors: *Florida, *Highways, *Beaches, *Right-of-way, Legislation, Judicial decisions, Legal aspects, Riparian rights, Riparian land, Piers, Coasts, Coastal structures, Piles (Foundations), Recreation, Shores, Access routes, Damages, Remedies.

Plaintiff brought action against defendant riparian owner to recover damages for injuries sustained when plaintiff's car collided with a piling which supported defendant's pier. Such pier extended over a beach which was used as a public highway. Plaintiff contended that defendant negligently maintained the pier by failing to provide proper lighting or other warnings of the pier's presence. Defendant argued that the pier was properly lit, that plaintiff was contributorily negligent in speeding and joy-riding on the beach and that the beach was not a public highway. Affirming a judgment for plaintiff, the court held that, although a riparian owner has a right to maintain a pier as a means of access to the ocean, if the legislature designates a portion of the shore for use as a public highway, the riparian owner will be liable for any negligence resulting in injuries to members of the public using the beach for highway purposes. (Liptak-Florida)
W71-01587

MISSISSIPPI EX REL RICE V STEWART (DISTINCTION BETWEEN FRESH WATER STREAMS AND TIDE-WATER STREAMS AS TO OWNERSHIP OF BEDS).
185 So 247-249 (Miss 1939).

Descriptors: *Mississippi, *Riparian rights, *Ownership of beds, *Streambeds, Legal aspects, Riparian land, Judicial decisions, Boundaries (Property), High water mark, Streams, Navigable waters, Tidal waters, Tidal effects, Intertidal areas, Adjudication procedure, Beds under water, Taxes.

Appellee riparian owners sought to assert res judicata in a suit brought by appellant State of Mississippi involving taxation of streambeds abutting their land. Appellees contended that no distinction should be made between rights of riparian owners in the beds of fresh water streams and those of abutting owners in the beds of inland tide-water streams when such distinction is made without regard to navigability in fact. Appellants contended that such distinction should exist; and by case law, a riparian owner of a fresh water stream owns the bed to the center of the stream. The Supreme Court of Mississippi held that stare decisis compelled the distinction between fresh water streambeds and tide-water stream beds. Consequently, the court found that since appellees were the owners of lands abutting a fresh water stream, they owned the beds in question and were liable for taxes on them. (Quesada-Florida)
W71-01588

SHARP V LEARNED (BOUNDARY BETWEEN STATES WHEN THE RIVER THREAD CHANGES).
188 So 302-305 (Miss 1939).

Descriptors: *Mississippi, *Boundaries (Property), *Islands, *Mississippi River, Rivers, State jurisdiction, State governments, Lumbering, Judicial decisions, Legal aspects, Louisiana, Real property, Land tenure, Boundary disputes.
Identifiers: *Thread of the stream.

Plaintiff timber cutter sought to enjoin defendant riparian landowner from prosecuting a suit against plaintiff in Louisiana courts for cutting timber. The island upon which the timber was cut was in the Mississippi River. The mainstream of the river had changed from the Louisiana side of the island to the Mississippi side. Therefore, defendant contended that the island was now in Louisiana rather than Mississippi. The court stated that the boundary line of a navigable river between two states is the thread of the stream, adding that the boundary varies with the thread. However, the court noted an exception to this general rule that when the thread changes, and flows between land and the state to which it belongs, the land remains the territory of the state, and the state boundary continues to be the old thread. Consequently, the court held that the island was still in Mississippi, and affirmed the decision of the lower court for plaintiff. (Hart-Florida)
W71-01589

CAPLES V TALIAFERRO (OWNERSHIP OF SUBMERGED LANDS).

197 So 872-875 (Fla 1940).

Descriptors: *Florida, *Administrative agencies, *Riparian land, *Ownership of beds, Beds, State governments, Beds under water, Bays, Judicial decisions, Legal aspects, Real property, Land tenure.
Identifiers: *Submerged lands.

In a suit to quiet title to riparian and submerged lands, the court held that where a riparian landowner purchased submerged land in front of his upland from the Trustees of the Internal Improvement Fund, and later mortgaged the upland except for a narrow beachfront strip, the mortgagee was not entitled to the submerged lands upon foreclosure. (Hart-Florida)
W71-01590

ANDERSON-TULLY CO V CAMPBELL (BOUNDARY DISPUTE AS TO OWNERSHIP OF ACCRETION).

10 So 2d 445-447 (Miss 1942).

Descriptors: *Boundary disputes, *Mississippi, *Accretion (Legal aspects), *Boundaries (Property), Legal aspects, Navigable rivers, Mississippi River, Meanders, River beds, Banks, Shores, Judicial decisions, Riparian rights, Real property, Damages.

Plaintiff, owner of riparian property formed by accretion, sought to enjoin defendant timber company from cutting timber on his property. Defendant contended that the disputed strip of riparian land was deeded to it by a common grantor. Plaintiff contended that the land in question was excepted from the grant to defendant and was later granted to him after being enlarged through accretion. The Supreme Court of Mississippi held that the land in question was excepted from the grant to defendant by the common grantor and was later conveyed to plaintiff. The court issued a permanent injunction against defendant but disallowed the damages given to plaintiff by the trial court other than the actual value of the trees cut. (Quesada-Florida)
W71-01591

BRIDGEHEAD LAND CO V HALE (EFFECT OF EASEMENTS FOR ROAD CONSTRUCTION ON RIPARIAN RIGHTS).
199 So 361-363 (Fla 1940).

Descriptors: *Florida, *Riparian rights, *Roads, *Easements, Bridges, Landfills, Land forming, Road construction, Rivers, Ownership of beds, Boundaries (Property), Legislation, Administrative agencies, River beds, Riparian land, State governments, Judicial decisions, Legal aspects, Adjudication procedure, Cities, Riparian waters.

Plaintiff riparian landowner brought an action in ejectment against defendant board members of the state road department. Plaintiff had conveyed an easement to defendant across his land, which abutted a river. Defendant constructed a road on the easement, filling in the river to construct a bridge. Plaintiff sought to eject defendant from the filled portion, contending his riparian rights had been violated. The court noted that: (1) the fill was constructed on the river bed which was bested in the local municipality by a valid legislative grant; (2) full title was vested in defendant by legislation; (3) plaintiff had duly conveyed the easement to defendant; and (4) the burden was upon plaintiff to show that his riparian rights were violated. The lower court's judgment of nonsuit for defendant was affirmed since plaintiff failed to prove a violation of his riparian rights. (Hart-Florida)
W71-01592

UNITED STATES GYPSUM CO V REYNOLDS (CHANGE OF RIVER BED OVER LONG PERIOD OF TIME PRESUMED TO BE BY EROSION AND ACCRETION).
18 So 2d 448-450 (Miss 1944).

Descriptors: *Mississippi, *Accretion (Legal aspects), *Bank erosion, *Boundaries (Property), Avulsion, Banks, Boundary disputes, Navigable rivers, Legal aspects, Judicial decisions, Equitable apportionment, Riparian land, Riparian rights, Mississippi River, River beds, River training, Meanders.

Plaintiff riparian owners filed a suit seeking to have the ownership of accretions formed by the changing of a river's course over a period of years established in their favor. Defendants, owners of the opposite bank, contended that there was no evidence of accretion by gradual change, but rather that there was an avulsion by which the river made a complete departure from its original course for a short time. Defendants contended that they were entitled to ownership of the dry bed before the river returned to its old bed. Plaintiffs contended that there was gradual erosion and accretion that preceded the avulsion, and that they were the owners of the allegedly accreted land in question when the river returned to its former bed. The Supreme Court of Mississippi held that a presumption of gradual erosion and accretion exists when a river gradually changes course, and therefore plaintiffs had acquired title to the land in question before the avulsion. (Quesada-Florida)
W71-01593

STRECKFUS STEAMERS, INC V FOX (RIGHT OF STATE TO TAX SALES ABOARD STEAMBOAT IN NAVIGABLE RIVER).
14 F Supp 312-317 (SD W Va 1936).

Descriptors: *West Virginia, *Taxes, *Navigable rivers, *State governments, Legal aspects, Legislation, Judicial decisions, Boundaries (Property), Admiralty, Low water mark, Boats, Ohio River, Navigation, Interstate rivers, State jurisdiction, Federal jurisdiction.

Plaintiff corporation sought to enjoin the collection of state sales and license taxes on business conducted aboard its steamboat while crossing the Ohio River. Three contentions were made by plaintiff: (1) since the Ohio River forms the boundary between West Virginia and Ohio, the excursions were in interstate commerce; (2) the levying of taxes in the river was beyond the power of West Virginia because of a territorial ordinance; and (3) the United States had exclusive jurisdiction over a navigable river. Defendant tax commissioner contended that the taxes imposed were only for those sales made within the boundaries of the state and that states had concurrent jurisdiction over navigable rivers. The tax commissioner further asserted that the excursions did not constitute interstate commerce. The court held that: (1) Plaintiff did not bear the burden of showing the trips to be within interstate commerce; (2) West Virginia did have the power to tax sales on navigable waters within its boundaries but not in Ohio; and (3) the jurisdiction of the United States over navigable rivers is exclusive only with respect to navigation and interstate commerce. The court denied the injunction to restrain the collection of all taxes except those levied on sums derived from the sale of tickets in Ohio. (Quesada-Florida)
W71-01594

UNITED STATES V CARROLL OIL TERMINALS, INC (ACCIDENTAL OIL LEAKAGE CAUSED BY STORM DAMAGE).
18 F Supp 1008-1009 (ED NY 1937).

Descriptors: *New York, *Water pollution sources, *Pollutants, *Oil wastes, Harbors, Legislation, Pollution abatement, Legal aspects, Judicial decisions, Water quality control, Standards, Admiralty, Ships, Ports, Inland waterways, Piers, Oily water, Federal government, Federal jurisdiction.

Plaintiff United States brought suit against defendant corporation charging it with unlawfully discharging oil into New York Harbor in violation of federal statutes. Defendant contended that the oil leakage occurred as a result of storm damage to its vessel while such vessel was properly moored. The court held that the spill resulted from circumstances beyond the defendant's control, and therefore defendant was found not quilty. (Quesada-Florida)
W71-01595

THE WATUPPA (VESSEL LIABLE FOR DUMPING WASTE OUTSIDE AUTHORIZED AREA).
19 F Supp 493-494 (SD NY 1937).

Descriptors: *New York, *Dredging, *Disposal, *Solid wastes, Waste dumps, Water pollution sources, Legal aspects, Judicial decisions, Quality control, Standards, Harbors, Water pollution control, Legislation, Pollution abatement, Pollutants.

Plaintiff United States brought action against defendant steamtug and scow for dumping of dredged material outside of designated dumping grounds. Defendant steamtug contended that its function was only to tow the scow to the dumping and therefore it should not be liable. Defendant scow stipulated its liability but contended that it was accidental and not due to faulty equipment. The court held that the tug's activity was unrelated and hence it was not liable. The court held defendant scow liable but, due to the accidental nature of the incident, it was fined the minimum amount. (Quesada-Florida)
W71-01596

UNITED STATES V APPALACHIAN ELEC POWER CO (NAVIGABILITY OF RIVERS IN RELATION TO INTERSTATE COMMERCE).
23 F Supp 83-117 (WD Va 1938).

Descriptors: *Virginia, *Hydroelectric plants, *Navigable waters, *Interstate rivers, Federal government, Federal jurisdiction, Federal-state water rights conflicts, Hydroelectric project licensing, Industries, Judicial decisions, Jurisdiction, Legal aspects, Legislation, Public rights, Relative rights, Interstate commissions, State governments, Watercourses (Legal), Supervisory control (Power), Federal Power Act, Navigation.

Defendant power company had commenced construction of a dam across a stream which it contended was non-navigable. Defendant further contended that if the stream were found to be navigable, it was nevertheless located entirely within the State of Virginia and not subject to the jurisdiction of plaintiff United States. Plaintiff sought to enjoin further construction, contending that the stream was navigable and that since a navigable river into which it emptied crossed state lines, it was involved in interstate commerce. In a lengthy opinion consisting mainly of fact details, the court concluded that navigability is a fact question based on whether the stream is susceptible of being used in its ordinary condition as a highway for commerce over which trade and travel may be conducted in customary modes of trade and travel on water. The stream must be tested in its natural condition and may not be given the status of navigability by legislative declaration. In view of the evidence presented, the court held that the stream in question was both non-navigable and intrastate. (Clark-Florida)
W71-01597

ISELIN V LA COSTE (TITLE TO ACCRETIVE LANDS).
55 F Supp 977-981 (WD La 1944).

Descriptors: *Louisiana, *Boundary disputes, *Accretion (Legal aspects), *Avulsion, Thalweg, Boundaries (Property), Judicial decisions, Legal aspects, River beds, Mississippi River, Navigable waters, River flow, Meanders, Mississippi, Alteration of flow, Obstruction to flow, Remedies, Channels.

Plaintiffs, Louisiana residents, sought by declaratory judgment to establish their ownership in certain accreted lands. Plaintiffs alleged that the lands had

uddenly appeared on the Louisiana side of the lississippi River as a result of the river's suddenly ifting course during high water. Defendants ar- ued that the formation of the land was gradual and atural and, as a result, should belong to the state f Mississippi. The United States District Court, Vestern District of Louisiana, agreed with defen- ants and stated that, where the main channel of a ream forms the boundary between states and radual changes occur in topography of banks or lands, the main channel of the stream continues be the boundary. Where avulsion occurs and the ourse of the stream suddenly changes, the boun- ary remains the old center of the bed. Here, the ift was gradual and the boundary line followed e thread of the stream. Therefore, the accretion ecame property within the state of Mississippi. Barnett-Florida)
71-01598

OMMONWEALTH V PHILADELPHIA AND EADING IRON AND COAL CO (POLLUTION F WATER SUPPLIES AS PUBLIC NUISANCE).
) Pa D and C 411-422 (1943).

escriptors: *Pennsylvania, *Water supply, Public rights, *Coal mine wastes, Legal aspects, dicial decisions, Remedies, Water pollution, astes, Water sources, Public health, Navigation, avigable rivers, Tributaries, Water pollution urces, State governments, Local governments, llution abatement, Municipal water, Regulation, djudication procedure, Beds under water.
entifiers: *Public nuisance.

aintiffs, state attorney general and City of iladelphia, sought to enjoin 24 coal companies om discharging coal silt or refuse into the huykill River or its tributaries. Plaintiffs alleged at the coal pollution was endangering the health people whose water supply was provided by the er and also was harming navigation by building the bed of the river. On a preliminary motion, e court held that if the plaintiffs could prove de- ndants were responsible for the alleged condi- ns, defendants would be guilty of creating a blic nuisance, and an injunction would issue. operty rights between private owners may be lanced, but where a fundamental public right is volved, a private right must give way. Purity of ater supplies is such a fundamental public right. efendants' contention that not all polluters were ined was not a bar to the suit; defendants might ggest others who should be added. (Morris- orida)
71-01599

ETZ V HOFFMAN (UNLAWFUL OBSTRUC- ON TO STREAMFLOW).

Monroe L R 34-39 (Pa Eq 1945).

escriptors: *Pennsylvania, *Obstruction to flow, Riparian rights, *Natural flow doctrine, Water hts, Competing uses, Relative rights, Legal pects, Judicial decisions, Stream flow, Lakes, nds, Natural flow, Alteration of flow, Mill dams, easonable use, Remedies, Riparian land, Riparian ters, Water sources, Damages.

aintiff operated an ice manufacturing plant at the e of an old grist mill by means of waterpower ob- ned from an adjacent creek. Water in the creek wed from an upstream lake. Defendant ob- ucted the flow of water from the lake, decreasing e amount of water power obtainable at plaintiff's nt by one-third. Plaintiff's rights in the water of e creek derived from a grant from the previous ner of the grist mill, who had established the ht to use of the creek for water power. Plaintiff ught an injunction restraining defendant from in- fering with his water rights and sought damages r his decreased capacity to produce ice. The urt found that plaintiff was entitled by grant to e use of the normal flow of water from the pond. e court issued an injunction against defendant's ntinued obstruction of flow in the creek and as- sessed damages against defendant for plaintiff's lost profits which resulted from the decreased flow and for plaintiff's expenses in removing the obstruc- tions erected by defendant. (Dye-Florida)
W71-01600

WEST PENN RY V UMBEL (PROPERTY DAMAGE RESULTING FROM ROCK SLIDE; NEGLIGENT CONTAINMENT OF WATER).
8 Fay L J 231-237 (Pa C P 1944).

Descriptors: *Pennsylvania, *Impoundments, *Earth dams, *Landslides, Safety factors, Rockfill dams, Barriers, Legal aspects, Judicial decisions, Strip mines, Standing waters, Strip mine wastes, Mining, Land use, Industrial wastes, Impounded waters, Erosion, Adjudication procedure, Rail- roads, Earthworks.

Plaintiff railway corporation sued defendant strip mining operators for damage to its railway tracks caused by an earth slide. Plaintiffs contended that defendants had negligently constructed earthen mounds behind which a pond of standing water had formed. Plaintiff corporation further contended that the standing water weakened the mounds by erosion and thus caused the damaging earth slide. Defendant miners contended that the construction of the mounds and the collection of water did not constitute negligence. The Court of Common Pleas for Fayette County, Pennsylvania held for plain- tiffs, stating that the evidence in the trial below sup- ported a finding of negligence by the jury. (Ques- ada-Florida)
W71-01601

PUBLIC SERV COMM'N V SINKING SPRING WATER CO (REQUIRING POTABLE WATER FROM SUPPLIER).
46 Dauph 9-17 (Pa Eq 1938).

Descriptors: *Pennsylvania, *Water supply, *Dis- tribution systems, *Public health, Water pollution, Water quality, Water policy, Water loss, Adminis- trative agencies, Legislation, Wastes, Remedies, Potable water, Artesian wells, Water sources, Springs, Legal aspects, Judicial decisions, Public rights, Public utilities, Water loss.
Identifiers: *Contempt.

Plaintiff public utility commission secured an in- junction against defendant water company to force it to furnish potable water, to quit using sources not approved by the health department and to cease from distributing contaminated water. Plaintiff later asked the court to hold the defendant and its general manager in contempt for failure to comply. Defendant answered that it had attempted to comply by drilling eight wells and seeking to sell out to two boroughs. The court found that the de- fendant failed to eliminate unnecessary leakage which prevented an adequate supply of water from reaching homes and schools and knowingly pumped contaminated water from a spring into the distribution system, even after the health depart- ment ordered it to quit such pumping. For this and for failure to comply with the court order to pro- vide an adequate supply of potable water to con- sumers, the court found defendant in contempt. (Morris-Florida)
W71-01602

COMMONWEALTH EX REL MARGIOTTI V DELAWARE DIV CANAL CO (CANAL OWNER- SHIP AS AFFECTED BY BREACH OF COVE- NANT TO MAINTAIN AS A CANAL).

45 DAUPH 234-251 (Pa Eq 1938).

Descriptors: *Pennsylvania, *Canals, *Navigation, *Maintenance, Water law, Legislation, Judicial decisions, Legal aspects, State governments, Trans- portation, Water supply, Inland waterways, Rail- roads, Navigable waters, Recreation facilities, Parks, Remedies, Land tenure, Relative rights, Bridges, Real property, Claims (Contracts).

Plaintiff state sought to require defendant canal company to either forfeit a canal to the state for failure to operate it as a canal or to require restora- tion and operation of the canal. Plaintiff had sold the canal to defendant's assignor with a clause requiring the purchaser and his assignees to keep it functioning. The canal was operated for over 70 years, after which 40 miles of it were sold to the plaintiff to become a state park. The state per- mitted decay of the canal and lowered overhead bridges, preventing use of the canal for commercial navigation. The court found that the clause in the original sale contract was not a condition sub- sequent, but a covenant running with the land, which was enforceable at law. However, the court held that since the state permitted the canal's dis- use, it could not force the defendant to restore it. The court also held that the defendant was entitled under a state law to use the canal to operate a water supply business. (Morris-Florida)
W71-01603

FURJANIC V METROPOLITAN EDISON CO (RELIEF FROM CANAL OVERFLOW BARRED BY LACHES).
47 DAUPH 187-189 (Pa Eq 1939).

Descriptors: *Pennsylvania, *Concrete-lined canals, *Flood damage, *Remedies, Bank erosion, Banks, Repairing, Legal aspects, Judicial decisions, Drainage water, Running waters, Surface waters, Erosion control, Bank stabilization, Overflow, Canal embankments, Adjudication procedure.

Plaintiff landowners sought to enjoin defendant corporation from permitting water to flow onto their lands. Plaintiffs alleged that defendant caused the overflow by maintaining its concrete canal em- bankments and adjacent ravine in a state of disrepair. Additionally, the landowners sought damages for injury to their lands and crops. Defen- dant contended that the plaintiffs were barred by laches. The Dauphin, Pennsylvania County Court held that, since plaintiffs had waited ten years to bring their action, they were precluded from ob- taining equitable relief. (Quesada-Florida)
W71-01604

HEARINGS ON WATERSHED PROJECTS BE- FORE THE SUBCOMMITTEE ON CONSERVA- TION AND CREDIT OF THE COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 90th CONGRESS, 1st SES- SION.
Hearings--Subcom on Conservation and Credit, Comm on Agriculture, US House of Reps, Feb 15, 16, 17, June 28, 29, July 26, Nov 2, 1967.

Descriptors: *Flood protection, *Watersheds (Basins), *Project purposes, *Project benefits, Watershed management, Water resources develop- ment, Watershed Protect. and Flood Prev. Act, Flood control, Recreation, Irrigation, Water supply, Soil management, Sediment control, Struc- tures, Channel improvement, Crop production, Grasslands, Pastures, Federal project policy, Federal government, Local governments, Financ- ing, Project planning, Basins, Stream improvement.

Hearings before the Subcommittee on Conserva- tion and Credit of the House Committee on Agriculture were held to consider approving watershed projects in various sections of the United States. With few exceptions, the Subcommittee sought to approve only those projects whose prima- ry purpose was flood prevention, thereby following the policy and guidelines of the Watershed Protec- tion and Flood Prevention Act. Such incidental benefits as recreation, irrigation and municipal water supply which were consistent with good soil and water management were considered secondary to flood prevention. Flood prevention measures in- cluded in the projects involved land treatment for watershed protection, floodwater retarding struc- tures, stream channel improvement and debris basins for sediment control. The predominant type of land in the watersheds considered was cropland. However, watershed land use included grassland,

woodland, pastureland and urban property. The projects exhibited planning at both the federal and local levels. Local financing supplemented the federal assistance called for in most plans. (Finman-Florida)
W71-01605

STATE EX REL O'CONNOR V SORENSON (NEW PROPERTY BOUNDARY CAUSED BY NEW HIGH WATER MARK WHEN RIVER WAS DAMMED).
271 NW 234-239 (Iowa 1937).

Descriptors: *Iowa, *Riparian land, *High water mark, *Boundaries (Property), Riparian rights, Ownership of beds, Prescriptive rights, Riparian waters, Dams, Rivers, River beds, Beds under water, Navigable rivers, State governments, State jurisdiction, Reservation doctrine, Judicial decisions, Legal aspects, Crop production.

Plaintiff state brought action against defendant riparian landowner to quiet title to submerged land. Plaintiff had dammed a river below the disputed site 20 years earlier, raising the high water mark. Defendant contended that his property extended into the river to the old high water mark. Plaintiff asserted that its title in the river bed extended to the new high water mark. The court found that: (1) the ordinary high water mark is not the line reached by unusual floods, but the line to which high water ordinarily reaches; (2) the high water mark is co-terminous with the river bed, and only the land destroyed for agricultural purposes is considered the bed; (3) the location of a high water mark is a fact question; (4) the high water mark of a navigable stream is the division between the river bed and adjoining private property; and (5) riparian rights will be acquired along the artificial channel of a natural stream. Finding that plaintiff had established title by prescription, and that defendant had acquired his title after plaintiff's damming of the river so that even his property description referred to the new high water mark, the court found title to the land in question to be in plaintiff. (Hart-Florida)
W71-01606

MERIDIAN TOWNSHIP V PALMER (PUBLIC EASEMENT ACROSS RELICTION).
279 Mich 586, 273 NW 277-280 (1937).

Descriptors: *Michigan, *Lakes, *Accretion (Legal aspects), *Riparian rights, Competing uses, Ownership of beds, Relative rights, Riparian land, Riparian waters, Usufructuary right, Navigable waters, Swimming, Public rights, Easements, Roads, Lake shores, Cities, High water mark, Low water mark, Reservation doctrine, Legal aspects, Judicial decisions.

Plaintiff township sought an injunction against defendant littoral landowner to prevent defendant from charging the public for use of a beach and to remove a fence which prevented access to a lake. Defendant owned land along a lake; a road passed along the shore through defendant's land. A reliction formed between the road and lake, and defendant began operating a commercial beach. Plaintiff did not deny defendant's ownership of the reliction, but claimed that the reliction was subject to the same public easement as the roadway because the lake was navigable. The court noted that although the riparian owner could not erect structures between the high and low water mark of the lake, the public had no right of passage over the same area, because, despite title in the state, the riparian owner had exclusive use of the reliction and could erect bathing houses for his business or pleasure. Rejecting plaintiff's contention that the public acquired an easement upon the reliction along with the roadway easement, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01607

WILKINSON V CITY OF INDIANOLA (OVERFLOW OF CITY SEWAGE SYSTEM).
278 NW 326-327 (Iowa 1938).

Descriptors: *Iowa, *Sewers, *Overflow, *Municipal wastes, Cities, Water injury, Drainage systems, Sewage disposal, Storm drains, Storm runoff, Rain, Rain water manholes, Public health, Judicial decisions, Legal aspects, Adjudication procedure, Damages, Surface runoff, Surface waters, Surface drainage.

Plaintiff property owner sued defendant city for damages resulting from the overflow of municipal sewage onto plaintiff's land. Defendant had opened the surface water intake to a sewer, although the sewer was solely designed for sewage disposal and was inadequate for storm sewer purposes; the sewer had overflowed onto plaintiff's land on several occasions. Plaintiff contended that defendant was negligent in opening the storm intakes. The court held that the evidence was sufficient to be presented to the jury, and affirmed the judgment of the lower court for plaintiff. (Hart-Florida)
W71-01608

SHELDON V CHAMBERS (TITLE TO SUBMERGED LAND).
281 NW 438-441 (Iowa 1938).

Descriptors: *Iowa, *Accretion (Legal aspects), *Bank erosion, *Boundaries (Property), Riparian land, Rivers, Missouri River, River flow, Flooding, Submergence, Erosion, Judicial decisions, Legal aspects, Real property, Land tenure.

Plaintiff riparian landowner brought action against defendant landowners to quiet title to riparian land. The Missouri River had covered the contested land for 10 years. Plaintiff contended the land was totally eroded by the river, ceasing to exist as lands in place, and was now his property by accretion. Defendants responded that the lands had never eroded away, and that even if total erosion had occurred, the accretion belonged to other riparian owners. The court found that mere disappearance of the land because of flooding would not suffice to destroy defendants' ownership. Furthermore, the court found that if the land had totally eroded away and accreted back, plaintiff had not established his right to the accreted land. The evidence was held to have established defendants' title. (Hart-Florida)
W71-01609

STATE V M SUPPLE AND SONS CO (STATE INTERFERENCE WITH CONSTRUCTION OF BULKHEAD NOT IN NAVIGABLE WATERS).
290 NW 139-142 (Wis 1940).

Descriptors: *Wisconsin, *Breakwaters, *Bulkheads, *Lake beds, Bulkhead line, Navigable waters, Permits, Structures, Lake shores, Lakes, Inland waterways, Relative rights, Shores, Shore protection, Waves (Water), Navigation, Water levels, Swamps, Marshes, Judicial decisions, Legal aspects.

Pursuant to a government permit and for shore protection, defendant constructed a bulkhead between a lake shore and the shallow water of the lake. Plaintiff State of Wisconsin contended the bulkhead was on a bed beneath navigable waters and that defendant could not construct anything thereon without plaintiff's consent. The court ruled that the trial court had found as a fact that the bulkhead was not on the bed of navigable waters. The evidence was sufficient to support such finding. Judgment for defendant was affirmed. (Price-Florida)
W71-01610

LATHAM V DES MOINES ELECTRIC LIGHT CO (WATER DAMAGE CAUSED BY BURSTING STORM SEWER).
296 NW 372-376 (Iowa 1941).

Descriptors: *Iowa, *Sewers, *Electrical equipment, *Water injury, Drainage systems, Storm drains, Power system operations, Electrical networks, Powerline carriers, Transmission lines, Bundled conductors, Electric power, Electric power industry, Electric wires, Underground structures, Underground, Water pressure, Judicial decisions, Legal aspects, Adjudication procedure, Damages, Surface runoff.

Plaintiff building owner sued defendant electric company for damages to his building caused by a broken sewer. Defendant had installed an electrical conduit across a sewer which was laid under the street in front of plaintiff's building. The conduit occupied the top 40% of the sewer's interior diameter. During a heavy rainfall, the sewer burst at the conduit-sewer intersection, causing the water to escape, wash away the foundation of plaintiff's building, and collapse a wall. Plaintiff contended that defendant had negligently installed the conduit so as to obstruct the sewer and that this was the proximate cause of his injury. The court stated that defendant should have used reasonable care in installing the conduit, and that defendant was negligent if it had obstructed the sewer so that injury to others was reasonably apparent. Finding that the evidence established a question for a jury, the court held that the lower court had erred in directing a verdict for defendant. (Hart-Florida)
W71-01611

HUBER V CITY OF BLUE EARTH (MERE PASSING OF CITY ORDINANCE NOT EFFECTIVE AS DEFENSE TO STREAM POLLUTION FROM SEWER).
6 NW2d 471-473 (Minn 1942).

Descriptors: *Minnesota, *Canneries, *Water pollution sources, *Legislation, Cities, Sewers, Effluents, Sewage, Outlets, Tile drains, Local governments, Water pollution effects, Water pollution control, Sewage treatment, Sewage effluents, Sewage disposal, Legal aspects, Judicial decisions, Riparian land.

Plaintiff landowner brought action against defendant city for damages caused to his riparian land by stream pollution. Defendant had allowed untreated sewage and offensive effluents from a cannery to flow through its sewers into the stream. Defendant contended that its sewer was a condition and not the proximate cause of the nuisance. Moreover, defendant denied liability for the pollution caused by the canning factory because it had passed an ordinance prohibiting the deposition of effluents through sewers. The court ruled that the city sewer was the proximate cause of the pollution and rejected the defense proffered concerning the ordinance. The liability of cities for pollution of water by sewage is well established. The city could not by mere passage of an ordinance relieve itself of its fundamental duty or delegate its responsibility for injuries to those who connected with the sewer. Based on expert testimony, the jury was capable of determining the part of the pollution for which defendant was liable and the part attributable to the factory. The judgment for plaintiff was affirmed. (Price-Florida)
W71-01612

PLATTSMOUTH BRIDGE CO V GLOBE OIL AND REFINING CO (OWNERSHIP OF ACCRETIVE LANDS).
7 NW2d 409-412 (Iowa 1943).

Descriptors: *Iowa, *Boundary disputes, *Boundaries (Property), *Accretion (Legal aspects), Legal aspects, Judicial decisions, Navigable waters, Eminent domain, Legislation, Permits, Federal government, Missouri River, Patents, Bridges, Easements, Right-of-way, Alluvium, Land tenure, Real property.

Defendant constructed a pipeline across land under plaintiff's bridge. Plaintiff contended the land was accretive land and based his claim thereto on deeds

rom his predecessors and on a favorable decree in
prior quiet title suit. Plaintiff sought an injunction
o restrain defendant from using its property. De-
endant contended the land was not accretive land
nd therefore that the deeds and quiet title decree
id not affect title thereto. Based on the evidence,
he appellate court agreed with the trial court that
he land was accretive and belonged to plaintiff.
Defendant was therefore a trespassor. The
udgment for plaintiff was affirmed. (Price-Florida)
V71-01613

IUERTH V TOWN OF PRAIRIE DU SAC (JURY QUESTION AS TO WHETHER STATUTORY REQUIREMENTS WERE MET RELATING TO PROPER DRAINAGE).
46 Wis 25, 16 NW2d 422-424 (1944).

Descriptors: *Wisconsin, *Drainage practices, Surface waters, *Highway effects, Marshes, Marsh plants, Percolation, Culverts, Floodwater, Gradation, Graded, Grading, Natural flow, Ditches, Seepage, Obstruction to flow, Legislation, Drains, Drainage, Drainage effects, Adjudication Procedure, Judicial decisions, Legal aspects.

Plaintiff owned marshy lands on which he grew, during certain parts of the year, valuable hay. Defendant constructed a highway near plaintiff's property and provided for drainage of surface water. Plaintiff contended his land was flooded and his ability to grow hay destroyed as a result of the alleged negligent laying of the drains and the inadequate number thereof. Defendant denied such allegations. The trial court directed a verdict for defendant. The state statute on which plaintiff relied required the maintaining of culverts and outlets to permit natural drainage. The appellate court held that the evidence presented at trial was sufficient to require a jury determination. A new trial was granted. (Price-Florida)
V71-01614

LATTER V CITY OF DES MOINES (DUTY OF CITY TO MAINTAIN SEWER).
1 NW2d 787-791 (Iowa 1946).

Descriptors: *Iowa, *Damages, *Sewers, *Cities, Overflow, Levees, Floods, Rainfall, Judicial decisions, Legal aspects, Cultivated lands, Sediments, Sewage, Sewage effluents, Local governments, Flooding, Remedies, Repairing, Maintenance, Adjudication procedure.

Plaintiff brought action for damages to his property caused when a break developed in defendant's sewer line and repeatedly flooded his premises. Plaintiff contended defendant was negligent in its maintenance of the sewer and in not repairing the break after having notice of the defect. Defendant contended plaintiff had failed to prove negligence on defendant's part as to the maintenance of the sewer, had failed to show reasonable opportunity for repair of the break, and that plaintiff's proof of damages was wholly conjectural and uncertain. The court ruled in defendant's favor so far as the allegation of negligence as to maintenance of the sewer was concerned, but ruled that the evidence was sufficient to create a jury question as to whether defendant was negligent in not making the needed repairs during the time interval between the floodings. So far as property damage was concerned, there was insufficient evidence to go to the jury. However, damages as to inconvenience and noxious odors were ascertainable. Judgment for defendant was reversed. (Price-Florida)
V71-01615

TATE V KNOWLES-LOMBARD CO (USE OF AND BETWEEN HIGH AND LOW WATER MARKS).
38 A 275-276 (Conn 1936).

Descriptors: *Connecticut, *Boundaries (Property), *High water mark, *Low water mark, Boundary disputes, Judicial decisions, Land tenure, Legal aspects, Proprietary power, Public rights, Relative rights, Riparian land, Riparian rights, State governments, Usufructuary rights, Access routes.

Defendant owned land adjacent to a sound and was engaged in removing and selling sand located between the high and low water marks adjacent thereto. Plaintiff state claimed that it had title to that area of the beach and that defendant had no right to remove the sand without its permission. The court held it to be well settled that the state owned that part of a beach lying between the high and low water marks. Defendant, as a riparian owner, possessed certain rights associated with access to the water. However, removal of soil between the high and low water marks was an act of ownership rather than an exercise of the right to access. The lower court decision in favor of plaintiff was affirmed. (Clarke-Florida)
W71-01616

CAHILL V MAYOR AND CITY COUNCIL OF BALTIMORE (PERMIT TO CONSTRUCT WHARF INTO NAVIGABLE RIVER).
196 A 305-310 (Md 1938).

Descriptors: *Maryland, *Docks, *Permits, *Riparian rights, Piers, Navigable rivers, Rivers, Navigable waters, Riparian waters, Riparian land, Legislation, Remedies, Judicial decisions, Engineering structures, Governments, Regulation, Cities.
Identifiers: *Mandamus.

In an action for mandamus, plaintiff riparian landowner sought to compel defendant city officials to issue him a permit to construct a wharf from his property into a navigable river. Plaintiff contended that defendants' refusal to issue the permit was error in that it was based on a municipal ordinance which was invalid. Plaintiff argued that the ordinance was restrictive of the right, which had been granted by a general state statute, of riparian landowners to construct wharves. Defendants contended that the ordinance, in establishing pierhead lines, merely qualified the right granted by the statute. The court held that the statute and the ordinance were reconcilable and that the establishment of pierhead lines within the city was a legitimate qualification of the statutory right. Therefore, there was ample justification for the officials' refusal to issue the petition. The mandamus was denied. (Snow-Florida)
W71-01617

GRAY V GRAY (VALIDITY OF LAND PATENTS UNDER NAVIGABLE STREAMS).

16 A2d 166-172 (Md 1940).

Descriptors: *Maryland, *Patents, *Navigable rivers, *Land tenure, Judicial decisions, Legal aspects, Legislation, Proprietary power, Land, Governments, Ownership of beds, Relative rights, Riparian land, Watercourses (Legal), Streams, Rivers, Navigable waters, Navigation.

Two disputes arose concerning the validity of patents to certain lands granted to defendants by the state. A stream, flowing across the lands in question, could in parts be traversed by small boats and in parts could not. A Maryland statute provided that no patent could be issued for land covered by navigable waters. The court after defining navigable streams as those susceptible to use as highways of commerce, held that the stream in question satisfied this definition. Therefore, the court held that no lands covered by the stream could be passed by patent. (Clarke-Florida)
W71-01618

LANDIS V SEA ISLE CITY (RIPARIAN RIGHTS BETWEEN HIGH AND LOW WATER MARKS).
129 NJ Eq 217, 18 A2d 841-844 (1941).

Descriptors: *New Jersey, *Boundary disputes, *Easements, *Riparian rights, Boundaries (Property), Community development, Judicial decisions, Land tenure, Legal aspects, Leases, Local governments, Proprietary power, Relative rights, Recreation, Riparian land, Riparian waters, Public rights, High water mark, Low water mark.
Identifiers: *Dedications.

Plaintiff's predecessor in title to property located adjacent to the Atlantic Ocean dedicated an easement across his beach to public use. A New Jersey statute permitted a riparian owner adjacent to the ocean to apply for and receive from the state, a grant or lease for the lands fronting his property between the high and low water marks. In a quiet title action, plaintiff contended that such a grant or lease would not be subject to the easement dedicated to the public by his predecessor in title. Defendant city claimed the contrary. The court held that title to lands lying oceanward of the high water mark is in the state. As a riparian owner, plaintiff had no peculiar right to such lands fronting his property. He merely had a right to apply for a grant or lease from the state, which the state could grant or deny at its discretion. Plaintiff had no standing to bring a quiet title action concerning the land in question until title to it had acutally passed to him from the state. (Clarke-Florida)
W71-01619

TOWNSHIP OF LOWER V CITY OF WILDWOOD (STREAM AS A COMMON BOUNDARY BETWEEN TWO CITIES).

20 NJ Misc 22, 28 A2d 74-75 (1942).

Descriptors: *New Jersey, *Reservation doctrine, *Boundaries (Property), *Cities, High water mark, Low water mark, Boundary disputes, Navigable rivers, Ownership of beds, Bank erosion, State jurisdiction, Streams, Tidal waters, Judicial decisions, Legal aspects.

Plaintiff township petitioned for an appointment of commissioners to determine the location of a common boundary with defendant city. The boundary was a navigable creek. Plaintiff contended that the boundary should be monumented. The court stated that where title runs to the bank of a navigable tidal stream, the boundary could not be monumented. To arrive at this conclusion, the court noted that the municipal title ran to the high water mark, with the state reserving jurisdiction between high and low water marks. Therefore, the court found that the municipal police power did not extend past the low water mark, and hence monumenting would be superfluous. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-01620

CITY OF PHILADELPHIA V PENNSYLVANIA SUGAR CO (CONTEST OVER USE OF DOCK WATER AT END OF CITY STREET).
348 Pa 599, 36 A2d 653-656 (1944).

Descriptors: *Pennsylvania, *Riparian rights, *Reservation doctrine, *Riparian waters, Ownership of beds, Beds under water, High water mark, Low water mark, Navigation, Navigable rivers, Relative rights, Riparian land, Usufructuary right, State jurisdiction, Judicial decisions, Legal aspects, Cities, Docks.

Plaintiff city brought action against defendant sugar company to recover value for the use of dock water alongside defendant's wharf. Plaintiff's street ran to the river, culminating in a public landing, and defendant's wharf was contiguous to the street and extended into the river. Defendant had not used the public landing, but only the water in front of the street. Plaintiff contended sufficient ownership of the water to maintain the action. The court found that plaintiff could not restrict the public from use of the navigable water at the landing because: (1) a riparian owner has no property rights beyond low water mark; (2) title to land

below the high water mark is in the state; (3) title to the land of a riparian owner between high and low water mark is subject to the state's police power; (4) control over the dock space was in the state; and (5) whatever easement existed was subject to the state's police power. Noting that plaintiff had received no grant of the dock water from the state, the court concluded that plaintiff's asserted ownership was insufficient to maintain the action. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-01621

STATE V MALMQUIST (DAM OWNER'S DRAWDOWN OF LAKE AS NUISANCE).
40 A2d 534-541 (Vt 1944).

Descriptors: *Vermont, *Dams, *Drawdown, *Riparian rights, Water supply, Fish conservation, Fish migration, Fish populations, Reservation doctrine, State governments, Judicial decisions, Legal aspects, Adjudication procedure, Remedies, Water levels, Water level fluctuations, Mills.
Identifiers: *Injunction (Prohibitory), Public nuisance.

Plaintiff state sought an injunction to prevent defendant dam owner from arbitrarily drawing off water from a lake. Defendant's predecessors in interest had acquired title to the dam by legislative grant in order to raise the lake for operation of defendant's mills; however, neither mill had been operated by water power in recent years. Defendant attempted to force a littoral landowners association to buy his water rights, or give him unrestricted use of the lake water. Upon refusal, defendant attempted to intimidate the association by opening the dam. The court found that the plaintiff had standing to sue through the public interest in bathing, and through plaintiff's duty to preserve migratory and non-migratory fish for the public. The court stated that impairment of these interests was a public nuisance. Defendant contended that he had not lowered the lake below its natural level, but the court held that the artificial level had acquired such momentum that it had assumed a natural character. The legislative grant was construed to permit a reasonable use of lake water for the mills. However, non-mill use was found unreasonable and, because of defendant's threat, the injunction was granted. (Hart-Florida)
W71-01622

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RIPARIAN RIGHTS AND WATER QUALITY).

246 App Div 472, 284 NYS 598-608 (1936).

Descriptors: *New York, *Riparian rights, *Water pollution, *Sewage disposal, Water quality, Riparian waters, Judicial decisions, Legal aspects, Damages, Sewage effluents, Competing uses, Municipal water, Reasonable use, Public rights, Rivers, Streams, Navigable waters, Legislation, Shores, Beds, Wastes, Municipal wastes, Banks, Dredging, Domestic wastes, Overlying proprietors.

Plaintiff lower riparian owner sought damages and an injunction prohibiting defendant city from discharging sewage into a river in a manner which damaged plaintiff's commercial property rights. Defendant, pursuant to statutory authority, had constructed new sewer works which allegedly occasioned the damage. The lower court dismissed plaintiff's complaint, finding that plaintiff's method of dredging caused the river flow to deposit sewage on its lands. In reversing, the appellate court ruled that the state has title to the river beds, while both the state and subjects have an easement in the use of stream water. Riparian owners retain their common law riparian rights. Plaintiff was entitled to receive water from upper riparian owners without material alteration in quantity or quality. The right of defendant to construct sewage works did not make it immune from liability for damages in the absence of express authority. Plaintiff was entitled to injunctive relief and damages. The court stated further that a balancing of injuries should not affect its determination of the case. Injunctive relief, however, could be delayed until defendant could effect the means to avoid the pollution damaging plaintiff's lands. (Duss-Florida)
W71-01623

IN RE ROCHE'S BEACH V CITY OF NEW YORK (EMINENT DOMAIN AND AWARDS FOR SUBMERGED LANDS).
250 App Div 239, 294 NYS 22-26 (1937).

Descriptors: *New York, *Eminent domain, *Condemnation value, *Beds under water, Condemnation, Legal aspects, Judicial decisions, Land reclamation, Reclamation, Land appraisal, Beaches, High water mark, Ownership of beds, Boundaries (Property), Seashores, Tidal waters, Tides, Public benefits, Cities.

Appellant appealed from a portion of condemnation proceedings which made a nominal award for one parcel of land and nominal awards for several other parcels to unknown owners instead of the appellant. The City of New York had instituted proceedings to acquire title to various land and land under water for purposes of a public beach. Appellant received awards for condemned land under water to which he proved title, but had asserted title by adverse possession to other land parcels in question. The appellate court affirmed in part and reversed in part. Appellant had established title to various land under water, and the value of this land should have been predicated upon the practicability of reclamation by artificial means and upon the likelihood of the emergence of land in accordance with the cycle of change which prevailed upon the coast. Appellant had not established title by adverse possession to several other parcels of land and was not entitled to awards for these. The court reversed and remitted for further hearing as to the nominal award for one of the parcels which bounded appellant's land. (Duss-Florida)
W71-01624

HERSHEY BEVERAGE CORP V CITY OF SCHENECTADY (MUNICIPAL LIABILITY FOR FLOOD DAMAGES).
291 NYS 256-257 (App Div 1936).

Descriptors: *New York, *Sewers, *Flood water, *Storm runoff, Judicial decisions, Legal aspects, Damages, Rainfall, Storm drains, Storms, Outlets, Drains, Cities, Maintenance, Water injury, Precipitation excess, Operation and maintenance.

Plaintiff corporation brought a negligence action against defendant city for damages which resulted from flooding of its premises. Defendant allegedly had failed to install and maintain sewers adequate to drain rainfall without flooding a particular street and had improperly installed a sewer drain in such street. From a jury verdict for defendant, plaintiff appealed. In affirming per curiam, the court held that the jury could have reasonably found that plaintiff's cellar was damp at all times, that his premises were in a low section of the city, that the sewers were adequate, that the rainfall causing the damage was of extraordinary quantity, and that plaintiff's own outlets to sewers were improperly maintained. (Duss-Florida)
W71-01625

MAYO V WINDELS (DAMAGES FOR WATER DIVERSION).
255 App Div 22, 5 NYS2d 690-696 (1938).

Descriptors: *New York, *Diversion, *Water supply, *Compensation, Riparian rights, Legal aspects, Judicial decisions, Aqueducts, Dams, Construction, Competing uses, Eminent domain, Condemnation, Damages, Cities, Rivers, Streams, Tributaries, Land, Land use, Appraisals, Mills, Hudson River, Water utilization, Usufructuary right.

Plaintiff sought to institute proceedings to determine damages to plaintiff for New York City's excess water diversion from a river. Pursuant to legislation, the city had previously constructed an aqueduct and dam to divert river water to the city. The city had paid damages to injured parties based on the total diversion of the river waters if such total diversion became necessary in the future. The total diversion was not accomplished by the original works. Many years later, pursuant to a subsequent law, the city constructed a new aqueduct and dam below the original ones which resulted in the total diversion of the river. Plaintiff sought damages for this diversion. The lower court found that the prior award for damages did not cover the subsequent diversion since the city did not acquire any rights through it to divert waters below the original dam and aqueduct. The appellate court reversed, holding that the original law and award covered all possible diversion of water. One justice dissented, finding that it was clear that the prior award covered only diversion of water by the specific dam and aqueduct constructed. It did not cover new construction below the old dams pursuant to a later legislative act. (Duss-Florida)
W71-01626

APPLICATION OF GILLESPIE (COMPENSATION TO NEIGHBORING LANDOWNER FOR CONSTRUCTION OF AQUEDUCT).
173 Misc 591, 17 NYS2d 560-564 (1940).

Descriptors: *New York, *Administrative agencies, *Eminent domain, *Compensation, Cities, Aqueducts, Damages, Legal aspects, Judicial decisions, Construction, Water supply, Tunnels, Underground water supply, Structures, Easements, Right-of-way, Land use, Depreciation, Property values.

New York City constructed an aqueduct and other structures on land separated from petitioner's land by a county road. The City also obtained a subsurface easement under petitioner's land to convey water. Petitioner claimed compensation for damages to his property by virtue of a New York law which provided that contigious landowners to such projects could make claims. Petitioner alleged that he was inconvenienced by the project and that his property would temporarily decrease in value. Petitioner also sought compensation for change in the character of the land because of the project's proximity and for a permanent depreciation in its value. The Board of Water Supply denied petitioner any compensation for the alleged damages to his land and granted a nominal sum for the subsurface easement. The court confirmed the Board's decision, holding that the statute did not provide for relief for such damages. Furthermore, petitioner's claim of permanent depreciation was highly speculative. As for the subsurface easement, the court found that the Board's award was sufficient. (Duss-Florida)
W71-01627

ROCKLAND LIGHT AND POWER CO V CITY OF NEW YORK (DAMAGES PRESENTLY RECOVERABLE AS DEDUCTIBLE FROM TOTAL DAMAGES SUFFERED BY WATER DIVERSION).
263 App Div 284, 33 NYS2d 258-263 (App Div 1942).

Descriptors: *Hydroelectric plants, *New York, *Diversion, *Damages, Eminant domain, Alternation of flow, Judicial decisions, Legal aspects, Diversion dams, Obstruction to flow, Prior appropriation, Relative rights, Water utilization, Cities, Water control, Riparian rights, Engineering structures, Rivers, Adjudication procedure, Remedies.

Plaintiff hydroelectric company owned land, for use as a projected power development, adjacent to a river from which defendant city had appropriated water diversion rights. Above plaintiff's sites, defendant engaged in dam construction which would ultimately deplete the normal flow of water below

ıe dam, thus preventing plaintiff from further eveloping its project. Due to war conditions, the efendant's project might never be completed. laintiff brought an action for declaration of right ɔ claim damages for decrease in its property value y reason of defendant's proposed water diversion. laintiff contended that, should the city delay utting off the river water for many years, plaintiff ould be denied the right to prosecute its claims ecause of statutory limitations. The Appellate ivision of the Supreme Court of New York found ɔr plaintiff and held that permitting plaintiff to ecover the damages already accrued would not be nfair to the defendant since the amount so ecovered would be deductible from any total amages suffered by the company when and if the ty actually diverted the water. (Powell-Florida)
/71-01628

MITH V STATE (VALUATION OF PROPERTY ONDEMNED FOR HIGHWAY RELOCATION ND FLOOD CONTROL PROJECT).
3 NYS2d 58-61 (Ct Cl 1944).

escriptors: *New York, *Condemnation value, Highway relocation, *Flood control, H ighway ef-cts, Condemnation, Eminent domain, Compensa-ɔn, Judicial decisions, Legal aspects, Adjudica-ɔn procedure, Highways, Dams, Watershed anagement, Real property, State govenments, looding, Property values, Land appraisal.

laintiff landowner brought an action against de-ndant state to recover damages for the appropria-ɔn of property for a flood control and highway location project. Plaintiff contended that he was ntitled to the value of the land actually taken and e decrease, caused by the change in grade, in alue of his remaining land. Plaintiff also claimed alue for the general effect of the project on the eighborhood and the decreased usefulness of the roperty. The court awarded damages to plaintiff easured by the value of the land taken and the ecreased usefulness of the remaining property. owever, it held that it could not consider the eneral effect on the area, the change in grade, or ther effects which might easily be remedied. (Lip-k-Florida)
/71-01629

ITY OF PHILADELPHIA V STANDARD OIL O (RIPARIAN OWNER'S LIABILITY FOR ENT FOR USE OF CITY'S BULKHEAD).
9 F2d 764-771 (3rd Cir 1935).

escriptors: *Bulkheads, *Rent, *River basins, Pennsylvania, Docks, Navigable waters, Naviga-e rivers, Navigation, Riparian rights, Riparian aters, Coastal structures, Piers, Banks, Bank ero-ɔn, Channel improvement, River beds, Bank pro-ction, Erosion control, Silts, Sedimentation, Judi-al decisions, Legal aspects, Cities, Ships.

laintiff city brought action against defendant oil ɔmpany to recover the rental value of defendant's se of the city's bulkhead adjacent to defendant's parian property. Defendant had erected two harves and dredged a ship basin in front of its own nd the city's property. Plaintiff contended that a ate statute required riparian owners to pay for the se of city-owned bulkheads for the construction of harves or other wharf purposes, and that, but for e bulkhead which prevented mud and silt from ɔstructing defendant's basin, the wharves would e useless. Plaintiff also alleged that maintaining e accessibility of the wharves was a 'wharf pur-ɔse'. Defendant offered to pay rent for the portion the bulkhead actually used in constructing the ɔ wharves but contended that no payment was ıe for the ship basin since it was not a wharf pur-ɔse. Affirming a judgment for plaintiff for the nount tendered by defendant, the court held that ship basin was not a 'wharf, building in the nature a wharf, or a structure for other wharf purposes'. herefore, the statute did not require rent for the ıe of the bulkhead in connection with the basin. ne justic e dissented. (Liptak-Florida)
/71-01630

DU PONT RAYON CO V RICHMOND INDUSTRIES, INC (RIPARIAN RIGHT TO USE WATER VERSUS PUBLIC RIGHT TO USE STREAM FOR SEWAGE).
85 F2d 981-984 (4th Cir 1936).

Descriptors: *Virginia, *Water pollution, *Riparian rights, *Sewage disposal, Navigable waters, Sewers, Tidal waters, Competing uses, Rivers, Stream pollution, Judicial decisions, Legal aspects, Damages, Outlets, Water utilization, Public rights, Saline water, Municipal wastes, Waste disposal, Cities, State jurisdiction, Water rights, Cities.

Riparian factory owner appealed from an order denying an interlocutory injunction and dismissing its complaint in a suit to enjoin defendant dyeing company from discharging wastes through municipal sewers into the river above plaintiff. Plaintiff alleged that its manufacturing needs required water free from dyestuffs and that defendant's proposed plant would pollute plaintiff's water supply. The Circuit Court of Appeals affirmed the lower court. While riparian owners in Virginia are entitled to make reasonable use of water as it flows past their lands, the right on tidal, navigable waters is subject to the right of the public to use waters for sewage disposal. The beds of such waters are owned by the state, and it is for the state to determine what uses are to be made thereof and how much pollution it will permit to be emptied into such waters. Even as to tidal streams there is liability for pollution resulting from negligent or unreasonable use of sewers. However, nothing in this case indicated such a situation. (Duss-Florida)
W71-01631

CAROLINA POWER AND LIGHT CO V SOUTH CAROLINA PUBLIC SERV AUTH (LACK OF STANDING TO CHALLENGE STATE'S AUTHORITY TO CONSTRUCT POWER PROJECT).
94 F2d 520-526 (4th Cir 1938).

Descriptors: *South Carolina, *Administrative agencies, *Hydroelectric plants, *Navigation, Navigable waters, Hydroelectric power, Rivers, Streams, Hydroelectric project licensing, Projects, Obstruction to flow, Riparian rights, Diversion, Dams, Permits, Natural resources, Federal government, Channels, Legal aspects, Judicial decisions, Legislation, Public utilities, State governments, Adjudication procedure, Damages.

Plaintiff hydroelectric companies sought to enjoin the South Carolina Public Service Authority from constructing a power project and to enjoin the Federal Government from making a loan in aid of it. The project was designed to provide an improved water route and to generate electric power. To accomplish this, construction of a diversion dam would be necessary which would impair the navigability capacity of the stream. In the trial court plaintiffs attacked primarily the legality of the project from a legislative standpoint and the court ruled against them. The circuit court of appeals affirmed and found, moreover, that the plaintiffs had no standing to sue. They had no superior right to a license for the project, were not riparian owners that could be damaged, nor had any interest in navigation in the river. Their main damage would be that of competition, which in this case was lawful. Obstruction of the river was a matter for public authorities to decide and individuals could only complain if they suffered some direct or special injury. Plaintiffs presented no interest which was damaged. (Duss-Florida)
W71-01632

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONGRESS, 2ND SESSION.
Hearings--Subcomm on Conservation and Credit, Comm on Agriculture, US House of Reps, March 17, 18, June 11, 25, July 27, and Aug 19, 1964.

Descriptors: *Flood prevention, *Watershed management, *Watershed Protect. and Flood Prev. Act, *Legislation, Federal government, Mississippi River, Crop production, Crop response, Cultivated lands, Flooding, Floodwater, Floodways, Erosion, Gully erosion, Flood plains, Retention, Dams, Reservoirs, Municipal water.
Identifiers: *Congressional hearings.

Presented at these hearings before the Subcommittee on Conservation and Credit of the Committee on Agriculture of the House of Representatives, were plans for watershed projects in: Missouri, Iowa, Georgia, Arkansas, North Carolina, South Carolina, Texas, Vermont, New York, Delaware, Maryland, Indiana, Oklahoma, and Kentucky. The watershed projects were presented and defended by Representatives from the respective states. The main purpose for the proposal projects was flood prevention. Plans called for financing by the federal, state, and local governments. Federal assistance was sought as provided for in the Watershed Protection and Flood Prevention Act. (Price-Florida)
W71-01633

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.

Hearings--Subcomm on Conservation and Credit--Watershed Projects--Comm on Agriculture, US House of Representatives, March 2, July 16, 17, 18, Sept 19, 25, 1962.

Descriptors: *United States, *Flood protection, *Water resources development, *Watersheds (Basins), River basin development, Legislation, Multiple-purpose projects, Project benefits, Project purposes, Project feasibility, Project planning, Programs, Dams, Damsites, Reservoirs, River basins, Public benefits, Social aspects, Condemnation value, Flood control, Conservation, Cost-benefit ratio, Watershed management, Water policy, Cost sharing.

The Subcommittee on Conservation and Credit of the Committee on Agriculture of the U.S. House of Representatives met on several occasions to hear testimony concerning various watershed projects. The projects were proposed for several locations and covered a wide range of features. Testimony was offered by chairmen of the projects, Congressional representatives of the locations in question, and other interested parties from the various areas. Of particular concern to the committee were: (1) cost-benefit ratios, (2) size of the affected areas, (3) population to be affected by the project, and (4) the relative costs to be assumed by the federal government and the governments of the individual project locations. The committee took the projects under advisement, and no decisions were reached concerning the individual proposals. (Barker-Florida)
W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT--WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
Hearings on Watershed Projects--Subcomm on Conservation and Credit, Comm on Agriculture, US House of Representatives, July 21, 24, 25, Aug 15, 31, 1961.

Descriptors: *United States, *Flood protection, *Water resources development, *Watersheds (Basins), River basin development, Legislation, Multiple-purpose projects, Project benefits, Project purposes, Project feasibility, Project planning, Programs, Dams, Damsites, Reservoirs, River basins, Public benefits, Social aspects, Condemnation value, Flood control, Conservation, Cost-benefit ratio, Watershed management, Water policy, Cost sharing.

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W71-01635

HEARINGS AND REPORT ON DRAINAGE OF WETLANDS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
Hearings and Report--Subcomm on Conservation and Credit--Drainage of Wetlands--Comm on Agriculture, US House of Reps, Aug 18, 1961.

Descriptors: *Drainage programs, *Wetlands, *Legislation, *Wildlife conservation, Conservation, Drainage, Land reclamation, Water policy, Federal government, Legal aspects, Surface waters, Marshes, Water conservation, Water resources development, Cultivation, Land resources, Preservation, Administrative agencies, Financing, Farms, Farm management.

A hearing before the Subcommittee on Conservation and Credit of the Committee on Agriculture was held to hear testimony concerning two bills to amend the Soil Conservation and Domestic Allotment Act. One bill prohibited the Secretary of Agriculture from assisting a farm operator in the drainage of wetlands when such drainage would inhibit wildlife preservation. A second bill authorized the Secretary of Interior to deny financial and technical assistance, for drainage programs administered by the Department of Agriculture, in cases of specifically identified drainage areas on farms where wildlife preservation would be materially affected by such drainage. Testimony was offered by various public officials and private individuals who were interested in the bills. The Committee of Agriculture report accompanying the second bill discussed the purpose of the bill, the Department of Agriculture's policy on drainage, and the provisions of the bill. (Powell-Florida)
W71-01636

ECKART V CITY OF BELLEVILLE (CITY'S LIABILITY FOR WATER POLLUTION CAUSED BY DISCHARGE OF RAW SEWAGE INTO STREAM).
294 Ill App 144, 13 NE2d 641-644 (1938).

Descriptors: *Prescriptive rights, *Illinois, *Water pollution, *Municipal wastes, Compensation, Cities, Sewage sludge, Sewage, Sewage bacteria, Sewage effluents, Septic tanks, Sewage disposal, Streams, Riparian rights, Toxins, Pollutants, Fish-kill, Fouling, Odor, Oxygen sag, Worms, Legal aspects, Judicial decisions.
Identifiers: Nuisance (Public).

Plaintiff farmers sued to restrain defendant city from polluting a stream which flowed through plaintiffs' farms. Plaintiffs also sought to recover damages. Plaintiffs' evidence showed that defendant was discharging large quantities of raw, untreated sewage into the stream and that the stream was covered with soap scum and sludge, contained tubifex worms and fungus growth, and gave off vile odors. Plaintiffs contended that such a situation was a public nuisance. Defendant denied the pollution and contended that it had a prescriptive right to discharge sewage into the stream since it had been doing so for over five years. Affirming a judgment for plaintiffs, the court held that a city could not pollute a natural watercourse without compensating those injured thereby, and that the maintenance of a continuing and increasing nuisance cannot give rise to a prescriptive right to continue the nuisance. (Liptak-Florida)
W71-01637

BRADLEY V CITY OF MARLBORO (CITY'S LIABILITY FOR FLOODING CAUSED BY IMPROPERLY MAINTAINED CULVERT).

5 NE2d 439-442 (Mass 1936).

Descriptors: *Massachusetts, *Flood damage, *Culverts, *Compensation, Roads, Highways, Water injury, Rain water, Surface runoff, Overflow, Drains, Drainage water, Clay pipes, Storm drains, Surface drainage, Cities, Local governments, Judicial decisions, Legal aspects, Damages, Adjudication procedure, Jurisdiction.

Plaintiff landowners brought actions against defendant city to recover for damages caused by the negligent construction and maintenance of a culvert, which resulted in the flooding of plaintiffs' property during a rainstorm. Plaintiffs contended that the city superintendent of streets was acting as defendant's agent in constructing and maintaining the culvert and that defendant was liable for the superintendent's negligence. Defendant argued that the superintendent was acting as a public officer, a highway surveyor, and was not the city's agent. Reversing a judgment for plaintiffs, the court reviewed the applicable statutory provisions defining the authority of a superintendent of streets and concluded that the superintendent was a public officer rather than defendant's agent. Therefore, defendant could not be liable notwithstanding any showing of negligence or proximate cause. (Liptak-Florida)
W71-01638

LYON V CITY OF BINGHAMTON (CITY'S LIABILITY FOR DIVERTING WATER AND FOR TAKING POSSESSION OF MILLDAM).
281 NY 238, 22 NE2d 354-358 (1939).

Descriptors: *New York, *Riparian rights, *Diversion, *Milldams, Dams, Backwater, Natural flow doctrine, Condemnation, Condemnation value, Adjudication procedure, Judicial decisions, Legal aspects, Streams, Cities, Local governments, Riparian owners, Riparian water, Prescriptive rights, Reservoirs, Municipal water, Streamflow, Relative rights.

Defendant city had diverted stream water from a dam and then had seized the dam to prevent plaintiff dam owner from lowering the water level to a point which would have interfered with defendant's diverted water supply. Plaintiff brought suit and contended that defendant was liable for damages for diverting water from plaintiff's mill pond prior to the seizure of the dam and that plaintiff was entitled to recover possession of the dam or its reasonable value. Defendant contended that it had the right to divert the water by virtue of a prior judgment against plaintiff's co-owner, and that it was not liable for diverting water in which it had riparian rights. The court held that plaintiff was not bound by a judgment in a suit against a co-owner to which plaintiff was not a party, but that plaintiff could not recover for water diverted from a flowing stream without showing actual damages since water is not subject to ownership until reduced to possession. Impounding water behind a dam does not constitute possession. However, defendant was held liable for the market value of the dam and appurtenances wrongfully appropriated. (Liptak-Florida)
W71-01639

NEWKIRK V CITY OF TIPTON (SUIT FOR DAMAGES FOR REDUCTION IN LAND VALUE BECAUSE OF POLLUTION OF A STREAM).
136 SW2d 147-157 (Mo Ct App 1939).

Descriptors: *Missouri, *Water pollution, *Sewage effluents, *Property values, Damages, Cities, Treatment facilities, Sewage, Sewage disposal, Sewage treatment, Prescriptive rights, Depreciation, Water pollution sources, Water pollution effects, Legal aspects, Land tenure, Remedies, Riparian rights, Reasonable use, Condemnation value, Judicial decisions, Drainage, Prescriptive rights, Adjudication procedure.

Plaintiff sought damages for dimunition in value of his land as a result of upstream discharge of sewage by the defendant city's new treatment plant into a stream running through plaintiff's property. Although the city denied that its plant had caused any new pollution of the stream, the plaintiff presented evidence of injury to farm animals from drinking stream water, of fishkill, and of other pollution effects beginning at approximately the same time as commencement of operation of the plant. The city claimed that plaintiff, as a lower riparian owner, had no cause of action against it, citing authority to the effect that such a landowner must submit without compensation to municipal discharge of sewage. The court, however, looked to the reasonable use doctrine and held that defendant had no right to injure any lower riparian owner in discharging sewage. Moreover, past discharges by individual riparian owners gave the city no prescriptive right to dump sewage. However, as the trial court had failed to require a specific finding by the jury that defendant's discharge had polluted the water and directly damaged plaintiff, the decision below for the plaintiff was reversed. (Caldwell-Florida)
W71-01640

TALBERT V CITY OF WINCHESTER (FLOOD DAMAGE FROM DIVERTED SURFACE WATER).
277 Ky 164, 125 SW2d 1002-1005 (1939).

Descriptors: *Kentucky, *Culverts, *Flooding, *Diversion, Damages, Drainage, Flood damage, Alteration of flow, Ditches, Surface runoff, Diversion structures, Land tenure, Legal aspects, Judicial decisions, Cities, Drainage systems, Floods, Natural flow, Overflow, Adjudication procedure.

Plaintiff sought to enjoin defendant city from diverting surface waters onto his property. Plaintiff claimed that defendant had constructed a culvert which, in times of heavy rainfall, diverted water from a ditch onto his property and thereby flooded it. Defendant contended that the property was in a low place and that the conditions complained of were a result of natural drainage. There was conflicting evidence on whether the land's tendency to flood existed before the culvert was constructed. From a jury verdict for defendant, plaintiff appealed. The court held that plaintiff failed to show that any prejudicial error occurred at the trial, and affirmed the trial court's judgment for defendant. (Caldwell-Florida)
W71-01641

CITY OF COVINGTON V MCKINNEY (OBSTRUCTION CAUSING OVERFLOW AS PERMANENT WHERE NOT REMEDIABLE AT REASONABLE EXPENSE).
263 Ky 131, 92 SW2d 1-4 (1936).

Descriptors: *Obstruction to flow, *Kentucky, *Surface runoff, *Ditches, Prescriptive rights, Judicial decisions, Legal aspects, Overland flow, Cities, Municipal water, Reservoirs, Drainage water, Rainfall, Rain water, Barriers, Diversion, Water conveyance, Damages, Structures, Adjudication procedure, Overflow, Flooding.
Identifiers: *Permanent, *Temporary.

Defendant city, which maintained reservoirs for supplying municipal water, constructed ditches to collect and drain surface water from the reservoir land. Following an overflow onto plaintiff's land during ordinary rains, plaintiff brought an action alleging that defendant's ditches were inadequate to carry the water collected therein and that defendant had permitted them to become obstructed. Defendant contended that the ditches had constituted permanent structures for over forty years; consequently, defendant claimed a prescriptive right to maintain ditches for the flow of rain water from defendant's land onto plaintiff's premises. Defendant also contended that damage caused by the permanent structures required a single recovery, which was barred by the statute of limitations. The Kentucky Court of Appeals, in affirming the lower court's decision for plaintiff, held that defendant had failed to prove that the obstruction causing the overflow was not remediable at a reasonable expense. Therefore, defendant had not established a permanent structure. Since the ditches were only temporary structures, the defendant had not acquired a prescriptive right. (Powell-Florida)
W71-01642

THE ALBANIA (LIABILITY FOR DISCHARGE OF OIL IN HARBOR BY SHIP).

30 F2d 727-728 (SD NY 1928).

Descriptors: *New York, *River and Harbors Act, *Oil wastes, *Water pollution control Legal aspects, Judicial decisions, Remedies, Admiralty, Navigable waters, Federal government, Legislation, Harbors, Navigation, Ships, Pollutants, Water pollution, Water pollution effects, Water pollution sources, Regulation.

Libelant federal government sought to recover a penalty from respondent for discharging waste fuel oil into New York harbor. Respondent contended that the vessel did not violate the law, although one employee might have, and asserted that even if it was found to have violated the law, an 1888 act with a $250 minimum penalty would apply rather than the Rivers and Harbors Act of 1899 which had a $500 minimum penalty. The court found that the vessel's employee was acting in the service of the ship, whether instructed or not, and thus the ship violated the anti-discharge law. The court held the 1888 law would be applicable since it was specified in the Rivers and Harbors Act that the Act did not repeal or alter the provisions of the earlier act. The court further held although oil was not specifically listed in the 1888 act, oil was as dangerous to shipping as pollution with acid and came within the terms 'refuse' and 'other matter', the discharge of which was prohibitted. (Morris-Florida)
W71-01643

UNITED STATES V PENNSYLVANIA SALT MFG CO (RIGHT OF LANDOWNER ON NAVIGABLE WATERS TO MOOR VESSEL).
30 F2d 332-334 (3d Cir 1929).

Descriptors: *Pennsylvania, *Docks, *Bulkheads, *Riparian rights, Legislation, Judicial decisions, Remedies, Federal government, Contracts, Harbors, Piers, Navigable waters, Delaware River, Ships, Navigation, Navigable rivers, Bulkhead line, Riparian land, Legal aspects, Access routes.

Plaintiff federal government and its lessee sued to enjoin defendant manufacturing company from mooring vessels to plaintiff's bulkhead along a pier owned by defendant. Defendant claimed the right to moor both as an owner abutting navigable waters and by express reservation in a contract with plaintiff government. Plaintiff government, which owned an adjoining pier on the Delaware River in Philadelphia, had purchased a strip of defendant's pier and removed it to enlarge the slip between the two piers. The Court of Appeals, Third Circuit, in affirming a district court dismissal of plaintiff's request, held that the contract reserved the right of defendant to use the bulkhead built by the government after removal of part of the pier. Further, the old slip was part of the navigable water of the river, and the enlarged slip also became navigable water. Every landowner on navigable water has the right to free acess to such water and the right to moor vessels to a bulkhead on his own land. (Morris-Florida)
W71-01644

F D GLEASON COAL CO V UNITED STATES (REGULATION OF DREDGING IN NAVIGABLE WATERS).
30 F2d 22-25 (6th Cir 1929).

Descriptors: *Michigan, *River and Harbors Act, *Dredging, *Navigable rivers, Legal aspects, Judicial decisions, Remedies, Federal government, Legislation, Navigable waters, Navigation, Channels, Excavation, Inland waterways, Maps, Buoys, Regulation.

Plaintiff federal government charged defendant coal company with unauthorized dredging in a navigable river in violation of the Rivers and Harbors Act of 1899. Defendant contended that only dredging which altered the course of a channel was prohibited, that regulating such an innocuous act was not within the federal commerce power and that certain evidence showing its dredge to be on the American rather than the Canadian side of the channel should not have been admitted. The court, in affirming defendant's conviction, held that the Act should be construed to prohibit dredging or altering the course of navigable waters. The court stated that the fact that one act such as defendant's might not interfere with navigation did not mean Congress could not deal with such acts as a class when the overall effect could be harmful. The court also held that the evidence which showed the dredging to be on the American side of the channel was admissible. (Morris-Florida)
W71-01645

PETITION OF HIGHLANDS NAVIGATION CORP (LIMITATION OF LIABILITY FOR ABANDONING SUNKEN SHIP).
29 F2d 37-39 (2d Cir 1928).

Descriptors: *New York, *Rivers and Harbors Act, *Harbors, *Disasters, Legal aspects, Judicial decisions, Remedies, Damages, Legislation, Local governments, Piers, Docks, Navigable waters, Ships, Boats, Burning, Navigation, Channels, Cities, Admiralty, Costs, Cost repayment.

Petitioner filed for a limitation of liability after his two ships burned and sank in navigable waters off the piers of New York City. Petitioner abandoned the two vessels which were total losses. The city opposed the limitation, claiming a city ordinance required the owner of a sunken vessel to remove it and, if he did not, allowed the city to remove it and charge the cost to the vessel's owner. The Circuit Court of Appeals, Second Circuit, in affirming a district court order granting the limitation, held that the Rivers and Harbors Act of 1899 recognized the right of abandonment and was intended to preserve that right of maritime law. After giving proper notice to the Secretary of War, the owner of an abandoned vessel is not liable for damage caused by other vessels striking the abandoned vessel and is not liable for the cost of raising such vessel. The court held that since Congress granted such exemption, a city ordinance could not remove it. (Morris-Florida)
W71-01646

HIGGINS LUMBER AND EXPORT CO V DRACKETT (INTERPRETATION OF LEASE OF WHARF).
125 So 322-324 (La 1929).

Descriptors: *Louisiana, *Leases, *Docks, *Harbors, Boats, Ships, Legal aspects, Judicial decisions, Local governments, Damages, Piers, Port authorities, Navigable waters, Rent, Contracts, Repairing.

Plaintiff, lessee of a wharf, sued defendant steamboat owner for services rendered, labor and material. Defendant contended the charge for rent of the use of plaintiff's wharf was illegal under plaintiff's lease with the Board of Commissioners of the Port of New Orleans since such lease prohibitted subletting of wharfage. Defendant also claimed that plaintiff had agreed not to charge him for mooring his boat and barges. Plaintiff had repaired defendant's steamboat, but defendant had remained moored 54 more days to make additional repairs. The court, in affirming the trial court's judgment for plaintiff, held there was no subletting of the wharfage, but merely an agreement to allow defendant to use plaintiff's pilings and the facilities and equipment of its plant. Another clause in the lease requiring fees to be paid to the Board except when a vessel was in the harbor on business of plaintiff did not apply since defendant's boat was there originally to allow the plaintiff to repair it and remained there to use plaintiff's facilities. (Morris-Florida)
W71-01647

DEERING V MARTIN (SALE AND USE OF SOVEREIGNTY LANDS).
116 So 54-66 (Fla 1928).

Descriptors: *Florida, *Public rights, *Shoals, *Ownership of beds, Legal aspects, Judicial decisions, Remedies, State governments, Legislation, Islands, Public lands, Navigable waters, Beds, Sand bars, Beach erosion, Coastline, Ocean currents, Tidal waters, Water level fluctuations, Navigation, Atlantic Ocean, Boundaries (Property), Riparian rights, Administrative agencies, Relative rights.

Plaintiffs owned Key Biscayne's southermost section and sued to enjoin defendant Trustees of the Internal Improvement Fund of Florida from selling submerged lands south and west of Key Biscayne to codefendant Henderson. Defendant Henderson, who planned to bulkhead the submerged shoals and fill them in to create a series of islands, and the trustees demurred. The Supreme Court of Florida, in reversing the upholding of the demurrer, held that the lands were sovereignty lands under navigable waters and as such were subject to the public trust doctrine. The trustees could grant limited privileges for use of the land, but could not impair the rights of the people, even under a statute authorizing sale of such lands. Since plaintiffs would suffer particular injury if the land were illegally sold, they could properly seek relief from public nuisance. The court also found that the deed to defendant Henderson was too vague since it described the land granted as that where the water cover was less than three feet at high tide and that the complaint raised the question of whether any of the land was within that description. (Morris-Florida)
W71-01648

DAVIS V IVEY (LIABILITY FOR ALTERING FLOW OF SURFACE DRAINAGE).
112 So 264-273 (Fla 1927).

Descriptors: *Florida, *Alteration of flow, *Surface drainage, *Natural flow doctrine, Railroads, Flooding, Rainfall intensity, Damages, Roadbanks, Ditches, Embankments, Impounded waters, Obstruction to flow, Diversion, Diversion structures, Drainage, Surface waters, Cultivated lands, Judicial decisions, Legal aspects, Agriculture, Natural flow, Weather forecasting, Surface runoff.

Plaintiff landowner brought action to recover for losses allegedly resulting from defendant railroad's construction of a roadbed which obstructed the natural drainage of land adjacent to plaintiff's and caused water to back up onto plaintiff's property. Defendant contended that the flooding complained of was due to an act of God. The court ruled that failure to guard against an act of God that could have been guarded against was actionable negligence, and that a party changing the flow of water must provide against more than ordinary rainfall if such rainfall occurs occasionally, even

though at irregular intervals. The court found that the evidence was sufficient to sustain the lower court's judgment for plaintiff. (Price-Florida)
W71-01649

C A SCHNACK JEWELRY CO V O'SHEE REALTY CO (LIABILITY FOR INADEQUATE DRAINAGE OF RAIN WATER).
162 La 815, 111 So 174-177 (1927).

Descriptors: *Louisiana, *Seepage, *Drainage practices, *Water injury, Surface runoff, Damages, Drainage, Drainage water, Rain water, Leases, Prescriptive rights, Surface waters, Runoff, Waterproofing, Roofs, Drainage effects, Rainfall-runoff relationships, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff sought damages for injury to his building allegedly caused by water that accumulated on the roof of defendant's adjoining building as a result of defendant's failure to provide adequate drainage for rainwater. Defendant denied that the injury accruing to plaintiff was caused by his drainage practices. The court stated that plaintiff had the burden of proving the proximate cause of its injury, and held that plaintiff had failed to meet this burden. Since the evidence supported the lower court's finding for defendant, the judgment was affirmed. (Price-Florida)
W71-01650

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, TARRANT AND JOHNSON COUNTIES, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W71-01329

6G. Ecologic Impact of Water Development

SCIENCE AND TECHNOLOGY AND ITS APPLICATION TO THE PROBLEMS OF POLLUTION, TRANSPORTATION AND EMPLOYMENT. PUBLIC SCIENCE POLICY: BACKGROUND READINGS,
Federation of Rocky Mountain States, Inc., Denver, Colo.
Donald W. Galvin, and Nick Jannakos.
Available from NTIS as PB-190 500, $3.00 in paper copy, $0.95 in microfiche. Western State Conference, March 9-11, 1970, Salt Lake City. Various pagings.
Identifiers: *Air pollution, Management planning, *Management planning, Employment, *Water pollution, *Transportation, Economics, Organizations, United States government, Sociometrics, Urban areas, Rural areas, Population, Natural resources, Rocky Mountain states, State government, Local government, Technological development.

The document covers what government leaders and the science and technology community must do to set up the mechanism and lines of communication required to bring technology to bear on current public problems. It identifies potential applications of new technology to social problems in the areas of pollution, transportation, employment and future planning. It contains recommendations for federal, regional, interstate, state and local action in order to fully utilize science and technological resources, overcoming problems in federal-state relations, inter-agency relations, communications, financing, and manpower.
W71-01118

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,
Westinghouse Ocean Research Lab., San Diego, Calif.
For primary bibliographic entry see Field 05C.
W71-01266

THE CONVERGENCE OF ENVIRONMENTAL DISRUPTION,
Marshall I. Goldman.
Science, Vol 170, p 37-42, Oct. 2, 1970. 13 ref.

Descriptors: *Environment, *Environmental effects, *Social aspects, *Institutions, *Decision making, Aquatic environment, Conseration, Governments, Natural resources.
Identifiers: *Russia, Socialist governments.

Environmental disruption is as severe in Soviet Russia as it is in the United States. Although it has been often assumed that publicly owned factories could take into account social costs as well as private costs, state ownership of the country's productive resources may actually exacerbate the situation in some ways. In the largest Soviet republic, the RSFSR, only 35% of factories and 40% of cities and suburbs have treatment plants. The developments around Lake Baikal are already causing ecological damage. Air pollution and land erosion are largely uncontrolled. The soviets, no more than we, have been able to establish social costs of environmental pollution. Although the Soviets do have certain advantages such as the power to avoid wasteful production, state officials are usually judged on basis of the contribution to the nation's economic development, and pollution control is regarded as non-productive. (Whipple-Rutgers)
W71-01347

MAN AND HIS ENVIRONMENT.
G. Ansley Coale.
Science Vol. 170, p 132-136, Oct. 9, 1970.

Descriptors: *Environment, Environmental effects, *Social aspects, *Population, Institutions, Fecundity, Natural resources.
Identifiers: *Externalities, *Population control.

Economic factors are more important than population growth in threatening the quality of American life. Economists say that environmental pollution occurs through disregard of externalities. It is desirable to internalize externalities. We are using up the world's raw materials quite fast, but the purchases of raw materials from undeveloped countries have economic advantage to them. Population growth in the United States is discussed, and it is concluded that a rapid leveling off of our population growth is almost impossible but that a relatively moderate reduction in fertility would level population off with an increase of 35 or 40 per cent. As regards pollution, per capita increase in production has been more important than population growth. Various policies may be adopted to decrease adverse environmental effects, including particularly the limitation of population. (Whipple-Rutgers)
W71-01348

RESTORATION OF LOST AND DEGRADED HABITATS,
Smithsonian Institution, Washington, D.C.
Raymond F. Fosberg.
In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P., (The Natural History Press: Garden City, New York, 1966), p 502-515.

Descriptors: *Environmental effects, *Ecology, *Agricultural, Watersheds, *Lumbering, *Urbanization, *Industrial plants, *Flood damage, *Dredging, *Pollutants, Recreation demand, Aesthetics, Economic efficiency, Organic matter.
Identifiers: *National park system, *Elimination of species, *Erosion control, *Dessication.

Means of restoring destroyed and degraded areas to something approaching natural conditions are examined. Six biological consequences of habitat degradation are listed ranging from changes in the composition and structure of vegetation and biotic communities to creation of biological vacua. Causes of degradation discussed include: logging, agriculture, urbanization and industrialization, flooding, dredging and filling in shallow water, exploitation of material of the substratum, and habital degradation by pollution. The author contends that overcrowding will make restoration necessary; as the pressure on land increases, areas that are totally degraded and not being actively used are likely to be in demand for recreational uses of various sorts. Current attempts at restoration include efforts to rehabilitate overgrazed rangelands, retiring marginal agricultural land to establish hunting preserves and attempts by the National Park System to recreate in parks the ecological scene as viewed by the first Europeans. Eight major principles and approaches are discussed: (1) defining present ecological nature of the degraded habitat, (2) defining proposed ecological habital, (3) using natural succession if no time pressure exists, (4) selectively eliminating species under certain conditions, (5) building up significant organic matter to raw subsoil by planting species, (6) checking advanced erosions with plants or engineering, (7) short-cutting of succession under certain conditions, (8) protecting plants from undue dessication. A major problem is foreseen in determining when a complete functional community has been established. (Preckwinkle-Chicago)
W71-01367

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,
For primary bibliographic entry see Field 06E.
W71-01547

07. RESOURCES DATA

7A. Network Design

DESIGN OF WATER QUALITY SURVEILLANCE SYSTEMS - PHASE I - SYSTEMS ANALYSIS FRAMEWORK,
NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.
For primary bibliographic entry see Field 05A.
W71-01264

IBP DESERT RESEARCH UNDERWAY,
For primary bibliographic entry see Field 06A.
W71-01284

7B. Data Acquisition

RADIOMETRIC DETECTION OF OIL SLICKS,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 05A.
W71-01144

REMOTE SENSING OF COASTAL WATERS USING MULTISPECTRAL PHOTOGRAPHIC TECHNIQUES,
Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
Edward Yost, and Sondra Wenderoth.
Available from NTIS as AD-705 116, $3.00 in paper copy, $0.95 in microfiche. Technical Report SERG-TR-10, January 1970, 210 p. ONR Contract N00014-67-C-0281.
Identifiers: *Ocean surveillance, Multiband spectral reconnaissance, *Target recognition, Underwater, Sensors, Photographic techniques, Optical properties, Penetration, Band spectrum, Photographic emissions, Brightness, Color photography, Mexico Gulf, Remote sensing.

An evaluation of multispectral photographic techniques for optical penetration of water in Northeastern United States and Gulf of Mexico coastal waters showed the green spectral band to

maximize the detectability of underwater targets. This type of particulant matter in suspension in the water as well as the size and quantity of the particles significantly affects the ability to optically penetrate water. In general, the spectral band (493-543nm) when exposed to place the water mass at about unity density on the photographic emulsion, was found to give the best water penetration independent of altitude or time of day as long as solar glitter from the surface of the water was avoided. When optimally exposed, the images of surface and underwater objects showed greater chromatic enhancement in multispectral color renditions than on conventional Aerial Ektachrome color films. Multispectral negative color renditions were found to be equally as good as positive color images for achieving color differences between the water mass and submerged objects. An isoluminous color technique has been perfected. This photographic process eliminates the dimension of brightness from a multispectral color presentation. By this method, objects exhibiting subtle spectral differences which are normally obscured by the comparatively large brightness present in coastal waters can be detected.
W71-01162

SMALL CONCRETE SPECIMENS UNDER REPEATED COMPRESSIVE LOADS BY PULSE VELOCITY TECHNIQUE,
N. K. Raju.
Journal of Materials, Vol 5, No 2, p 262-272, June 1970. 11 p, 9 fig, 14 ref.

Descriptors: Concrete technology, *Test specimens, Stress-strain curves, Failure (Mechanics), Concretes, Fatigue (Mechanics), *Non-destructive tests, Static tests, *Concrete testing, *Compressive strength, Concrete control, Cracks.
Identifiers: Ultrasonic impulse method, Ultrasonic tests, *Pulse velocity tests, *Microcracks, High strength concretes.

Tests conducted on prismatic concrete specimens have revealed significant differences in the magnitude of pulse velocity decrease under static and repeated load systems. The ultrasonic pulse velocity technique was used to study microcracks formed in high-strength concrete in a state of uniaxial compression under static and repeated loads. The progressive nature of the failure in concrete under repeated loads was studied by the parameter percentage decrease in pulse velocity in relation to the percentage of fatigue life. An empirical relation between the parameters, established from test data, could be used to predict the remaining fatigue life of a partially fatigued specimen. The magnitude of decrease in the pulse velocity in the lateral direction under repeated compressive loads is nearly 3 times greater than that under static loads. (USBR)
W71-01310

FLOW METERS FOR WATER RESOURCE MANAGEMENT,
Agricultural Research Service, Phoenix, Ariz.
J. A. Replogle.
Water Resources Bulletin, Vol 6, No 3, p 345-374, May-June 1970. 30 p, 9 fig, 1 tab, 132 ref.

Descriptors: *Flow measurement, Fluid flow, *Flowmeters, History, Measuring instruments, Rotating meters, Volumetric meters, Metering, Water resources, Bibliographies, Weirs, Sharp crested weirs, Reviews, Rectangular weirs, Cipolletti weirs, Parshall flumes.
Identifiers: *Water resources management, Accuracy.

Regulated waterflow is an essential feature of modern civilization. Effective use of water resources by industrial, agricultural, and municipal processes, and as domestic conveniences requires controlled-flow systems. Closely related to this regulation is the requirement for flow measurement, the techniques of which have developed over many centuries. Because of the relatively long history of flowmetering and the multitude of improvements and new developments, a complete coverage of the subject is not possible. In this paper greater emphasis is placed on describing new developments and less conventional methods that are most usable for water resource applications and research studies, and less emphasis on older, generally familiar devices. Because of the diverse requirements in water measurement, few devices can be regarded as having no possible application. Selecting the most usable devices is somewhat arbitrary, but passing mention is made of most known devices for all fluids; reference material for more complete coverage of a particular device or system is included. Has 132 references. (USBR)
W71-01316

FLOW GRAPH MODELS OF THERMAL PROCESSES,
Windsor Univ. (Ontario).
W. K. Roots, and E. Tulunay.
Chemical and Process Engineering, - Heat Transfer Survey, 1970, p. 49-52.

Descriptors: *Heat transfer, Heat budget, Temperature, Heat balance, Heat flow, Heat Exchangers, Temperature control.
Identifiers: Graphical models, Flow graph models.

A method for modelling thermal processes by flow graph techniques has been developed. It facilitates analysis of final temperature states and related phenomena within the process. The method is generally applicable to analysis and design procedures for all thermal processes, although the article describes its application to fluidized-bed processes. In the diagrams all final temperature levels and materials involved are represented by geometric figures and branches between them. The rules for the construction and use of flow diagrams are derived and presented. The above analysis is advantageous for complete heat transfer processes that involve more than two materials. (Novotny-Vanderbilt)
W71-01343

PRIMARY PRODUCTION AS A FUNCTION OF THE STRUCTURE OF PHYTOPLANKTONIC ASSOCIATION (IN RUSSIAN),
Moscow State Univ. (USSR).
V. D. Fedorov.
Doklady Akademii nauk SSSR, Vol 192, No 4, p 901-904, 1970. 1 fig, 1 tab, 5 ref.

Descriptors: *Mathematical studies, *Phytoplankton, *Ecosystems, *Physiological ecology, Primary productivity, Marine microorganisms, Correlation analysis, Statistical methods.
Identifiers: White Sea, Karelian shores, Fisher index, Margalef index.

The physiological activity of an ecosystem was expressed as a function of the density of a species, the calculated maximum density of the same, and the total number of species in a given community. A statistically significant correlation between this function and the total or specific production of biomass permits estimates of the primary production entirely on the basis of phytoplanktonic samples. The estimates have been narrowed down through an introduction of a coefficient for the structural diversity of the association (D/Dmax). (Wilde-Wisconsin)
W71-01473

QUANTITATIVE SAMPLING WITH THREE BENTHIC DREDGES,
Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak. North Central Reservoir Investigations.
For primary bibliographic entry see Field 05C.
W71-01477

AN IMPLEMENT FOR TAKING LARGE UNDISTURBED CORE SAMPLES FROM LAKE SEDIMENTS (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 02H.
W71-01494

DETERMINATION OF ASSIMILABILITY OF ALGAE, YEASTS, AND BACTERIA BY CERTAIN REPRESENTATIVES OF CLADOCERA (IN RUSSIAN),
For primary bibliographic entry see Field 02H.
W71-01496

ACOUSTIC TECHNIQUES OF FISH POPULATION ESTIMATION WITH SPECIAL REFERENCE TO ECHO INTEGRATION,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 02H.
W71-01508

MICROBIAL CONTAMINATION IN SPACECRAFT WATER SYSTEM.
Aircraft Porous Media, Inc., Glen Cove, N.Y.
For primary bibliographic entry see Field 05B.
W71-01516

WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION FOR APPLICATION TO STUDY OF UNSATURATED FLOW OF SOIL WATER,
Washington State Univ., Pullman. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-01524

SPECTRAL SURVEY OF IRRIGATED REGIONAL CROPS AND SOILS ANNUAL REPORT, 1 OCT. 1968-30 SEP. 1969.
Agricultural Research Service, Weslaco, Tex.

Available from NTIS as N70-17517, $3.00 in paper copy, $0.95 in microfiche. September 30, 1969, various pagings. NASA-CR-107881, NASA ORDER R-09-038-002.
Identifiers: *Aerial photography, *Farm crops, *Infrared photography, *Soils, Agriculture, Diseases, Spectrophotometers.

Research reports on remote sensing investigations are presented. Applications include color recombinations imagery for soils and plants; reflectance of single leaves and plots of cotton, and detection of cellular discoloration in cotton; and the detection of insect damage and foot rot disease of citrus trees with infrared film. Reflectance produced by vegetation on a soil background was studied by isotropic light interacting with a compact plant leaf plant irradiance specified by Duntley equations, and incident and reflected short wavelength radiation. The relationship between near infrared reflectance and cotton maturity is described. Aerial film types, photointerpretation, and mapper imagery are also discussed. Details are given on the discrimination of vegetation by multispectral reflectance, the discrimination on infrared film of crop species and soil conditions, and 9-channel scanner data. The procurement of a field spectrometer and random errors associated with a spectrophotometer are mentioned. Trips to Brazil and Mexico by the agriculture representative to NASA's International Participation Program are also reported.
W71-01539

7C. Evaluation, Processing and Publication

ANNOTATED LIST OF PUBLICATIONS, 1895-1970,
Illinois State Water Survey, Urbana.

For primary bibliographic entry see Field 10.
W71-01105

A VARIABLE-BOUNDARY NUMERICAL TIDAL MODEL,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02L.
W71-01167

THE USE OF LINEAR PROGRAMMING FOR ESTIMATING GEOHYDROLOGICAL PARAMETERS OF GROUNDWATER BASINS,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01193

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01194

EARTH RESOURCES RESEARCH DATA FACILITY INDEX.
National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.

National Aeronautics and Space Administration Manned Spacecraft Center Report MSC-02576, July 1970.

Descriptors: *Bibliographies, *Hydrologic data, Maps, *Research facilities, Remote sensing, Data collections, Oceanography, Data Processing, Data storage and retrieval, Maps.
Identifiers: Lists, Reports available, National Aeronautics and Space Administration.

Hydrologic information and data that are available at the National Aeronautics and Space Administration's Manned Spacecraft Center are listed in this index as a part of Earth Resources Program information. Items in the hydrology section are listed under the following subtitles: Site maps; Site Descriptions; Mission Screening and Summary Reports; Technical Letter Reports; Summary Reports; Subject Related Documents; and Technical Reports. Also included is a section on oceanography. (Woodard-USGS)
W71-01206

LIST OF INTERNATIONAL HYDROLOGICAL DECADE STATIONS OF THE WORLD.
For primary bibliographic entry see Field 02A.
W71-01208

COMPUTER SIMULATION OF RIVERBED DEGRADATION AND AGGRADATION BY THE METHOD OF CHARACTERISTICS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02E.
W71-01212

SIMULATION FOR THE EFFECTIVE DISTRIBUTION OF WATER RESOURCES,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-01219

THE EXPANFION OF THE SCOPE AND ROLE OF HYDRO--A PROBLEM-ORIENTED COMPUTER LANGUAGE FOR WATER RESOURCES,
Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Civil Engineering; and General Analytics, Pittsburgh, Pa.
George Bugliarello, John T. Onstott, and and Lawrence A. Jostes.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 1-8, 1969. 8 p, 3 fig, 9 ref.

Descriptors: *Computer programs, *Hydraulics, *Water resources development, *Programming languages, Computers, Digital computers, Planning, Model studies, Data processing, Water quality, Water yield, Groundwater movement, Hydrology.
Identifiers: Computer language (Hydro).

Study of the need for a problem-oriented language for hydraulic engineering led to the development of the language HYDRO. From being initially intended as a language for simplifying the approach to the computer by the engineer, HYDRO has evolved toward the solution of the command and control problem in water resources systems. This paper surveys current developments in HYDRO in this direction, including extension to the area of water quality, and discusses the underlying philosophy. (Knapp-USGS)
W71-01222

MATHEMATICAL MODELLING ON DIGITAL COMPUTERS AND CALCULATIONS FOR MULTI-PURPOSE UTILIZATION OF STREAMFLOW,
For primary bibliographic entry see Field 06A.
W71-01228

FLOOD FORECAST AND FLOOD CONTROL BY COMPUTER,
Ministry of Construction, Morioka (Japan).
For primary bibliographic entry see Field 04A.
W71-01229

THE ANALYSIS OF UNSTEADY FLOW IN RIVERS BY AN ANALOGUE COMPUTER,
Public Works Research Inst. Tokyo (Japan).
Akihiko Tsuchiya, Kunimatsu Hoshihata, and Akira Takahashi.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 439-446, 1969. 8 p, 6 fig, 1 tab.

Descriptors: *Flood forecasting, *Analog computers, Routing, Flood routing, Stage-discharge relations, Unsteady flow, Model studies, Analog models, Hydraulic models.
Identifiers: Chikugo River (Japan).

Analog computers in which hydraulic variables are transformed to electric potential or current were developed to find the magnitude of each term in the equation of motion of unsteady flow in rivers. Reliability of the computer was verified by experimental flood propagation in an experimental flume. Chikugo River, Japan, was simulated in the computer and the flood protection project of the river was evaluated for various conditions. (Knapp-USGS)
W71-01230

A COMPUTER SIMULATION STUDY OF TRAVELTIMES OF INJECTED PARTICLES AND TIDE-WAVES IN WELL-MIXED ESTUARIES,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 02L.
W71-01252

ANALOG COMPUTERS FOR FOREST HYDROLOGY RESEARCH,
Washington Univ., Seattle. Inst. of Forest Products.
David W. Wooldridge, and John D. Fox, Jr.

Available from NTIS as PB-195 783, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Washington Water Research Center, Washington State Univ. Pullman, Sept 1970. 39 p, 16 fig, 32 ref, append. OWRR A-037-Wash (1).

Descriptors: *Water balance, Hydrology, *Soil-plant-atmosphere, *Computer simulation, *Forestry.

This project concentrated on (1) describing mathematically soil-plant-atmosphere systems in terms of water balance and continuity of mass equations and (2) working with analog computer theory and programming techniques for modeling above relations. This investigation suggests many possible applications in forest hydrology as well as applied and basic hydrology. General principles and methods of analog computer simulation are discussed. Examples of hydrologic models are presented, including surface flood runoff, a model for vertical transport processes from the forest cover to the soil system and a program for modeling one-dimensional soil-water flow with time. These models illustrate the capability and potential of analog simulation in forest hydrology. Verification was not attempted due to insufficient input data and the difficulty of converting discrete digital input data into analog input signals. Limitations and advantages of digital and analog simulations are discussed. (Wooldridge-Wash)
W71-01411

08. ENGINEERING WORKS

8A. Structures

CONSTRUCTION STRESSES IN DWORSHAK DAM,
California Univ., Berkeley. Structural Engineering Lab.
Jerome M. Raphael, and Ray W. Clough.
Available from NTIS as AD-701 895, $3.00 in paper copy, $0.95 in microfiche. Final report, April 1965, 78 p. Report No. 65-3. Contract DA-45-164-CIVENG-63-263.
Identifiers: *Dams, Stresses, Foundations (Structures), Reinforced concrete, Loading (Mechanics), Creep, Elasticity, Thermal stresses, Cracks, Mathematical models, Washington (State), Computer analysis, Computerized simulation, Finite element analysis, Dworshak Dam (Washington state).

Because of the successful use of the finite element analysis procedure in determining the distribution of stresses in the cracked section of Norfolk Dam, an investigation was made to see if it would be feasible to make a finite element analysis of the stresses in Dworshak Dam, taking into account the actual construction program for the dam, the individual temperature histories of each lift of concrete, and the time dependent elastic and creep properties of the concrete.
W71-01117

FAILURE STUDY OF AN OVERLOADED 96 IN. CONCRETE PIPE,
California State Div. of Highways. Materials and Research Dept.
Travis Smith, Earl C. Shirley, Robert E. Smith, and Dale W. Sathre.
Available from NTIS as PB-190 762, $3.00 in paper copy, $0.95 in microfiche. Final Report, February 1970. 33 p, append.
Identifiers: *Pipes, Concrete, *Underground structures, Loading (Mechanics), *Sanitary engineering, Pipes, Sewage, Soils, Compressive properties, California.

A three-year old 96-inch sewer in San Diego, designed for approximately 13 feet of cover, was abandoned because of overload from the construction of a new 40- 50-ft highway embankment. The portion of the pipe affected by the surcharge was studied through failure. The pipe failed as expected

and behaved thereafter as a flexible conduit. There was a marked variance in the relative distortion of the pipe at different locations; apparently because of differences in the bedding and compressibility of the layer of soil surrounding the pipe. It was concluded that a pipe located in compressible soil (either natural ground or embankment) and subjected to surcharge, can be overloaded because of the generation of passive earth pressures.
W71-01120

EROSION AND RIPRAP REQUIREMENTS AT CULVERT AND STORM-DRAIN OUTLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Joseph P. Bohan.
Available from NTIS as AD-702 247, $3.00 in paper copy, $0.95 in microfiche. January 1970. 18 p,tabs. Research Report H-70-2.
Identifiers: *Structures, Drainage, *Soils, Erosion, Pipes, Construction materials, Gravel, Stabilization, Terrain, Storms, Drainage, *Culverts, Riprap, Storm sewers, Embankments.

Investigations were conducted in experimental facilities to determine the characteristic of scour below a culvert outlet discharging onto a horizontal blanket of cohesionless soil and to develop guidance for designing riprap protection downstream of culvert and storm-drain outlets. Scour holes, produced by the discharge of various flows of several durations through culverts of various shapes and sizes, were observed and contoured. These data were obtained for several tailwater conditions and were used to develop generalized expressions describing the maximum length, width, depth, and volume of scour as functions of the flow duration and the Froude number of flow at the culvert outlet. Dimensionless scour profiles and cross sections, for low and high tailwater conditions, were also developed. Riprap blankets of various configurations and stone sizes were tested with several culvert sizes and shapes and various tailwater conditions to determine when displacement or failure occurred. The results were used to develop generalized relations to describe the stone size and appropriate blanket configuration required to prevent blanket failure and soil erosion, respectively, at a culvert or storm-drain outfall.
W71-01126

HYDRAULIC MODEL STUDIES OF AN ENERGY DISSIPATOR FOR A FIXED CONE VALVE AT THE UTE DAM OUTLET WORKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
G. L. Beichley.
Available from NTIS as PB-192 709, $3.00 in paper copy, $0.95 in microfiche. March 1970. 3 p, tabs. REC-OCE-70-11.
Identifiers: *Dams, Valves, *Valves, Performance (Engineering), Liquid jets, Control systems, Hydraulic models, Baffles, Modification kits, Conical bodies, Hydrodynamics, *Outlet works, *Energy dissipators, Stilling basins, Ute Dam.

Laboratory studies were made with a 1:8 scale model of Ute Dam outlet works to aid in the development of a basin-type energy dissipator. The existing outlet works is to be modified by installing a horizontal cylinder (fixed-cone) valve structure for controlling the discharge into a concrete outlet channel. Hydraulic model tests of the energy dissipator for the valve discharge revealed problems caused by submergence of the control valve, surging in the energy dissipator, and overtopping in the outlet channel. The preliminary design was modified to reduce submergence and to stabilize the flow in the energy dissipator and outlet channel.
W71-01142

PERE MARQUETTE RY V SIEGLE (LIABILITY FOR INTERFERENCE WITH ICE BUSINESS BY DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-01150

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics Inc., Laurel, Md.
For primary bibliographic entry see Field 05G.
W71-01172

ALPE GERA DAM,
G. Gentile.
Paper Engineering Foundation Research Conference Rapid Construction Concrete Dams (Asilomar, Calif, Mar 1970) Engineering Foundation, New York City. 21 p, 13 fig, 4 tab.

Descriptors: *Gravity dams, *Concrete dams, Concrete placing, Costs, Foreign construction, *Foreign design practices, Aggregates, Stress, Construction equipment, Concrete testing, Quality control, Frost action, Temperature, Construction joints, Contraction joints, Concrete control, Construction, Dams, Mass concrete.
Identifiers: Italy, Cement content, *Construction methods, Alpe Gera Dam, Italy.

The Alpe Gera Dam, located at an elevation of 2215 m above sea level, is a massive concrete gravity dam built in the middle of the Italian Alps during 1961-64, and is an example of rapid construction of concrete dams. To keep the cost down in such a massive structure, the structure was zoned and the cement content in zones of lesser stress was reduced. Construction methods used in earthfill dams were adopted to place large quantities of concrete rapidly, thus building the dam in horizontal layers using construction equipment moving over concrete only a few hours old. Concrete batching, quality control, testing, and methods of placement are discussed. 1,715,310 cu m of concrete were placed, with an average daily production of 2210 cu m and a miximum of 3925 cu m. (USBR)
W71-01305

THE OPTIMUM GRAVITY DAM,
California Univ., Berkeley.
J. M. Raphael.
Paper Engineering Foundation Research Conference on Rapid Construction Concrete Dams (Asilomar, Calif, Mar 1970) Engineering Foundation, New York City. 20 p, 11 fig.

Descriptors: Dams, Dam design, Concrete dams, Earth dams, Production, *Gravity dams, Optimum design, Earth materials, Mass concrete, Strength, *Optimization, Soil properties, Cohesion, Internal friction, Costs, Soil cement, Soil stability.
Identifiers: Dam stability, Concrete properties, *Soil cement dams, Construction methods, Materials handling, Cement content, Slope angles.

Similarity of the angle of internal friction of concrete and consolidated gravels led to the speculation that concrete and rockfill may be extremes of a whole class of materials having varying degrees of cohesion, depending on the relative quantity of cementitious materials, and that concrete gravity dams and earthfill dams may be extremes of a whole class of gravity dams varying continuously from one to the other. A method is presented for finding the optimum gravity dam having a volume between the extremes of a concrete and an earthfill dam and made up of a material having a cement content between the extremes of zero for earthfill and the maximum content for concrete. Examination from the standpoints of production and materials properties shows a tremendous difference between costs and properties of earthfill and mass concrete materials. Data are presented showing: (1) how the slope of an earthfill can be influenced by varying cohesion, (2) the variation of cohesion with change in cement content, and (3) the variation of cost with change in slope. The total cost of an earthfill dam is relatively unaffected by enriching the fill material with cement in the flatter slope range (2:1 to 3:1); significant economies occur in the steeper slope range. (USBR)
W71-01306

PERKINS V VERMONT HYDRO-ELECTRIC CORP (LIABILITY FOR FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01361

GENESYS - AN ATTEMPT TO RATIONALIZE THE USE OF COMPUTERS IN STRUCTURAL ENGINEERING,
Engineering Computations (England).
D. G. Alcock, and B. H. Shearing.
Structural Engineer, Vol 48, No 4, p 143-152, Apr 1970. 10 p, 10 fig, 9 ref.

Descriptors: *Structural design, *Structural analysis, Design tools, *Structural members, Structural engineering, Computer programs, Beams (Structural), Computer programming, Computers, Standards.
Identifiers: *Computer-aided design, Design practices, Computer applications, *GENESYS (Computer program), FORTRAN (Acronym).

GENESYS is a modular computing system developed to rationalize the use of computers in structural engineering. The system is machine independent to the user; the programming language used for GENESYS is GENTRAN, an extension of FORTRAN that deals automatically with a standard form of data. A command language is used to define new commands, permitting indefinite growth. Facilities are provided for filing information on tapes or discs, editing data, converting units, inserting variables in data, and controlling the layout of the printed page. All modules of a subsystem may refer to a digital model of the problem held in a central data bank. Virtual storage comes into play when the core storage overflows. New subroutines may be developed interpretatively before being compiled. Facilities for debugging and timing are available to the programmer.GENESYS may be used conversationally or conventionally in batch mode. (USBR)
W71-01390

SOME ARRANGEMENTS IN DESIGN AND CONSTRUCTION TO KEEP CONCRETE DAMS COMPETITIVE,
W. Ter Minassian, and P. Londe.
Pap, Eng Found Res Conf Asilomar Conf Grounds, Paris, France, 1970. 15 p, 3 tab.

Descriptors: *Concrete dams, Dams, *Dam construction, Dam design, Damsites, Concrete technology, Concrete placing, *Arch dams, *Diversion, *Multiple arch dams, Hydroelectric plants, Trenches, Dam foundations, Diversion works, Diversion tunnels, Prefabrication.
Identifiers: Cost savings.

The ultimate capital cost of a concrete dam can be kept much lower if the designer takes full advantage of all possibilities to reduce the volume of the dam, reduce construction difficulties, reduce construction time, and permit the earliest partial operation. Six major possibilities vital to keeping concrete dams competitive are discussed. (1) The increasing use of arch dams in wide valleys where previously only gravity dams were considered feasible has resulted in appreciable savings in concrete volume, formwork, and excavation area. (2) The use of multiple-arch design for very high dams incorporating large spans for the arches and cylindrical or conical shapes for simpler formwork has reduced the volume and cost of concrete. (3) Concrete dams can be built on sites where sound rock lies far below the surface by using open trenches, concrete shored trenches, or stoped adits to limit the volume of excavation. (4) Integrating the appurtenant works and powerplant in the common structure can be another element of financial economy, particularly where space is lacking. (5) River flow during construction can be handled with short diversion tunnels or by overtopping completed blocks. (6) Power generation can be started before completion of the dam without endangering the structure. (USBR)
W71-01391

PEOPLE V STATE TAX COMM'N (VALIDITY OF FRANCHISE ASSESSMENT OF RAILROAD BRIDGE AS AFFECTED BY NAVIGABILITY OF RIVERS).
For primary bibliographic entry see Field 06E.
W71-01426

DOONER V UNITED STATES (ARTIFICIALLY INDUCED FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01428

LAWRENCE V CITY OF LA GRANGE (DAMAGES RESULTING FROM CITY DRAINAGE FACILITIES).
For primary bibliographic entry see Field 06E.
W71-01435

KENTON V MASSMAN CONST CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF A DIKE).
For primary bibliographic entry see Field 06E.
W71-01440

IN RE VICKSBURG BRIDGE AND TERMINAL CO (CORPORATIONS ABILITY TO MORTGAGE BRIDGE CONSTRUCTED ON STATE-OWNED RIVERBED).
For primary bibliographic entry see Field 06E.
W71-01449

SOUTH CAROLINA EX REL MAYBANK V SOUTH CAROLINA ELEC AND GAS CO (JURISDICTION OVER NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-01453

WINTER CONSTRUCTION FROM COHESIVE EARTH IN THE FAR NORTH (DAM-CORE CONSTRUCTION FOR THE VILYUI HYDROELECTRIC PLANT),
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
E. N. Batenchuk, G. F. Biyanov, L. N. Toropov, and Yu. N. Myznikov.
Translated from Russian. Available from NTIS as TT-69-55098, $3.00 in paper copy, $0.95 in microfiche. Israel Program for Scientific Translations, Jerusalem, 1969. 73 p, 6 tab, 50 fig, 21 ref.
Identifiers: *Cold weather construction, Excavation, 8*Construction, Arctic regions, *Dams, USSR, Power plants (Establishments), Soil mechanics, Foundations (Structures), Freezing, Temperature, Permafrost, Quality control, Construction materials, Reinforced concrete.

Contents: General information on the hydrodevelopment; (Natural, climatic and geological conditions of the construction-site area, the hydrodevelopment structures); Dam materials; Search for a procedure for placing cohesive soils in winter; Dry filling of the dam core; Placing the loam into the dam core; Quality control during the placing of loam into the dam core; Some engineering and economic data on the winter placing of the loam dam-core fill.
W71-01512

CONTAINMENT AND COLLECTION DEVICES FOR OIL SLICKS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
For primary bibliographic entry see Field 05G.
W71-01528

EFFECTS OF METHOD B BACKFILL ON FLEXIBLE CULVERTS UNDER HIGH FILLS: CHADD CREEK VOLUME 2 (APPENDICES),
California State Div. of Highways. Bridge Dept.
For primary bibliographic entry see Field 04A.
W71-01540

BRIDGEHEAD LAND CO V HALE (EFFECT OF EASEMENTS FOR ROAD CONSTRUCTION ON RIPARIAN RIGHTS).
For primary bibliographic entry see Field 06E.
W71-01592

8B. Hydraulics

UNSTEADY FREE-SURFACE FLOW COMPUTATIONS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
E. Benjamin Wylie.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7683, p 2241-2251, November 1970. 11 p, 6 fig, 12 ref, 2 append. NSF Project GK-721.

Descriptors: Unsteady flow, *Computer programs, *Mathematical studies, Hydraulics, Overland flow, Open channel flow, Routing, Flood routing.
Identifiers: *Onsteady free-surface flow.

The solution of the free-surface equations for subcritical unsteady one dimensional flow are solved by four different formulations, each based on the method of characteristics. Advantages and disadvantages of each procedure are given. Examples emphasize the important features and corroborate a stability criterion. The implicit characteristics grid approach is the most accurate for overland flow situations or analysis of single channels; however, it is not useful for complex systems. The explicit rectangular grid is the simplest to program but may lead to instabilities if very large/time increments are used, and it is comparatively expensive for long-duration transients. (Knapp-USGS)
W71-01108

VARIATIONAL APPROACH TO NON-DARCY FLOW,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
John A. McCorquodale.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7694, p 2265-2278, November 1970. 14 p, 10 fig, 20 ref, 2 append.

Descriptors: *Darcys law, *Porous media, *Unsteady flow, *Groundwater movement, *Turbulent flow, Turbulence, Mathematical studies, Overland flow, Computer programs.
Identifiers: Variational calculus.

The principles of variational calculus are applied to solve the nonlinear partial differential equation for steady and unsteady unconfined non-Darcy flow through porous media. A functional is proposed which will yield solutions for the laminar, transitional and turbulent flow regimes. The solution represents the minimization of the rate of energy dissipation with enforced flow continuity. A finite element scheme is used to obtain the minimizing field. Examples of the method applied to steady and unsteady free surface flow is described in a rectangular rockfill section. The finite element and experimental flow fields are in good agreement. (Knapp-USGS)
W71-01109

INDETERMINATE HYDRAULICS OF ALLUVIAL CHANNELS,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02J.
W71-01110

DESIGN CRITERIA FOR CONTROLLED SCOUR AND ENERGY DISSIPATION AT CULVERT OUTLETS USING ROCK AND SILL,
South Dakota School of Mines and Technology, Rapid City.
Donald A. Thorson, and Arunprakash M. Shirole.
Available from NTIS as PB-190 564, $3.00 in paper copy, $0.95 in microfiche. 1969, 64 p.
Identifiers: *Roads, Drainage, *Erosion, Control systems, Rock (Geology), Kinetic energy, Offices, Jets, Model tests, Velocity, Design, Standards, South Dakota, Scouring, Culverts, Sills, Riprap, Energy dissipation, Stilling basins.

The study establishes the criteria for the effective design of rock-basin energy dissipators for flow from culverts without or with a transverse sill. Design-tables have been prepared on the basis of laboratory studies with culvert models. Models of standard end flares were used to simulate the culvert outlet conditions. Stable rock sizes and basin geometry can be determined using the design-tables developed in the study. The design-tables are applicable for angular rock as well as rounded rock. Worked examples use the tables for design of rock basins for no-scour situations and controlled depths of scour.
W71-01119

THE HYDRAULIC FILTER LEVEL OFFSET METHOD FOR THE FEEDBACK CONTROL OF CANAL CHECKS; COMPUTER PROGRAM FOR SYSTEM SIMULATION,
California Univ., Berkeley. Hydraulic Engineering Lab.
Michael J. Shand.
Available from NTIS as PB-189 480, $3.00 in paper copy, $0.95 in microfiche. June 1968. 132 p. Technical Report HEL-8-3. Contract DI-14-06-200-2337.
Identifiers: *Irrigation systems, Control systems, Liquid level control, Computer programs, Feedback, Check valves, Irrigation systems, Automatic, Mathematical models, Subroutines, *Irrigation canals, STAGAT computer program, CORNING computer program, Open channel control systems, Feedback control systems, *Automatic check gates.

The report describes a mathematical model which simulates unsteady flow in a trapezoidal canal with automatically controlled check gates between reaches. A computer program written for the model can be used to design, confirm and/or assist in modifying a control system for a particular canal. Flow charts and listings of the two source programs STAGAT and CORNING, required to make a complete study of a canal plus sample input and output data are included. The subroutine SETGAT that controls the check gate openings contains the calculations relating to the automatic downstream control systems. This control system involves a target water level established in a hydraulic filter well, which is connected by a capillary tube to the canal. The target value is the preselected depth of water in the canal at which the flow is zero and the gate is closed. A lowering of the water level in the hydraulic filter below the target value signals the upstream gate to open by an amount which is proportional to the offset from the target value. This ratio of the gate opening to the offset is the gain for the system. The subroutine SETGAT for any control system can be substituted provided the order of calculation within the subroutine remains the same.
W71-01130

LONG WAVE PROPAGATION IN A TRIANGULAR CHANNEL,
Naval Postgraduate School, Monterey, Calif.
William Toft Bowman.
Available from NTIS as AD-703 238, $3.00 in paper copy, $0.95 in microfiche. October, 1969. 46 p. MS Thesis.
Identifiers: *Shallow water, Water waves, *Water waves, Propagation, Laminar flow, Equations of motion, Hydrodynamics, Numerical analysis, Coriolis effect, Theses, Channel flow.

The purpose of the paper is to examine long wave propagation in a shallow channel of triangular cross section. Solutions for small scale (f&O), large scale (f not — O), symmetric and asymmetric channels are obtained. Results are shown to be consistent with earlier work for the fundamental mode (M — O), and with edgewave solutions over a gently slop-

ing bottom for the higher modes. A second class of waves (quasingeostrophic waves) is also obtained when the Coriolis effect is included. The results are compared with those for a rectangular channel.
W71-01137

DISPERSIVE LONG WAVES OF FINITE AMPLITUDE OVER AN UNEVEN BOTTOM,
Massachusetts Inst. of Tech., Cambridge.
Ole Secher Madsen, and Chiang C. Mei.
Available from NTIS as AD-700 301, $3.00 in paper copy, $0.95 in microfiche. November 1969. 10 p. Report No. 117.
Identifiers: *Water waves, Hydrodynamics, *Structures, Water waves, Design, Numerical analysis, Nonlinear systems, Beaches, Equation of motion, Theses.

Approximate equations for long waves are derived under assumptions similar to those of Boussineig and Korteweg and deVries. Numerical studies are performed using the method of characteristics. Four cases are investigated (1) solitary wave on a beach, (2) solitary wave on a shelf, (3) periodic waves generated in a wave tank of constant depth, (4) periodic wave on a shelf. It is discovered that complicated disintegration and evolution appear due to combined effects of nonlinearity and dispersion. Experimental evidence is presented.
W71-01157

HYDRAULIC STUDY OF FIVE FLOATING BREAKWATERS FOR USE IN RESERVOIRS,
California Univ., Berkeley. Hydraulic Engineering Lab.
Kenneth Chen, and Robert L. Wiegel.
Available from NTIS as PB-189 779, $3.00 in paper copy, $0.95 in microfiche. 30 September 1969, 25 p. HEL 20-2.
Identifiers: *Hydraulic accumulators, Water waves, *Breakwaters, Design, Mobile, Floating bodies, Mooring, Hydraulic models, Model tests, Dams, Performance (Engineering), California, *Floating breakwaters.

The report presents the results of hydraulic model tests of five floating breakwater models performed in the Hydraulic Engineering Laboratory, University of California, Berkeley, California, during January-June 1969. First, a study was made of numerous papers and reports on mobile breakwaters during the latter part of 1968. Based upon this work, three rigid floating breakwaters were designed, each based on a different concept of wave energy dissipation and reflection. The performance of each model is discussed.
W71-01170

ALLUVIAL RIVER BEHAVIOR - A FEW ASPECTS OF ITS SIMULATION IN A MODEL,
S. N. Gupta, J. P. Sharma, S. R. Jindal, and Satish Chandra.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 267-275, 1969. 9 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Hydraulic models, *River training, *Alluvial channels, *Meanders, *Dikes, Sediment transport, Stream stabilization, River regulation, Hydraulic similitude, Sediment transport.
Identifiers: India.

A number of training spurs, for alluvial river loops of varying arc/chord ratios, carrying flood flows to the extent of 0.6 million cfs, were designed with the aid of models at Bahadrabad Hydraulic Research Station of U. P. Irrigation Research Institute, Roorkee, India. The river was simulated in a model and the behavior of training spur was interpreted from the model study. The model indicated only that the river would be deflected favorably by the proposed repelling spurs, but actually the river shifted by an appreciable distance in the first flood season. In the case of Yamuna River at Lakhnauti embankment, the spurs, constructed after the study of river curvature from the actual site survey, shifted the river to a similar extent. Using the data of eight river loops where minimum lengths of repelling spurs were determined either with the aid of models or after study of river surveys, an empirical relationship was developed for calculating the required length of a spur to control river loops. (Knapp-USGS)
W71-01211

SIMULATION TECHNIQUES IN WATER RESOURCES SYSTEMS,
State Hydraulic Works, (Turkey). Dept. of Research.
For primary bibliographic entry see Field 02E.
W71-01215

ELECTRONIC ANALOGUES REPRESENTING NONLINEAR FLOW THROUGH OPEN CHANNELS AND FLOOD CONTROL STRUCTURES,
Central Water and Power Research Station, Poona (India).
K. V. Ramana Murthy.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 247-258, 1969. 12 p, 7 fig, 9 ref.

Descriptors: *Analog models, *Open channel flow, *Unsteady flow, Spillway crests, Waves (Water), Water storage, Hydraulics, Mathematical studies, Flood routing, Flood control, Water management (Applied), Reservoir operation, Hydrograph analysis.
Identifiers: Spillway flow.

Flow through open channels and flood control structures is governed by nonlinear laws. The resistance to flow decreases with increase in flow in open channels, resulting in the phenomena often accounted for by wave celerity and wedge storage. Because of the nonlinear relationship between head and discharge over spillway crests, the time of emptying decreases with increase in discharge. Electronic analogs taking into account these nonlinear characteristics are presented and their practical applicability is illustrated. (Knapp-USGS)
W71-01217

A MATHEMATICAL MODEL OF UNSTEADY FLOW IN A NATURAL OR ARTIFICIAL WATER COURSE,
Vattenbyggnadsbyran, Stockholm (Sweden).
For primary bibliographic entry see Field 02E.
W71-01224

AMPLITUDE-DISSIPATIVE AND PHASE-DISSIPATIVE SCHEMES FOR HYDRAULIC JUMP STIMULATION,
Technische Hogeschool, Delft (Netherlands).
M. B. Abbott, G. Marshall, G. S. Rodenhuis, and T. Ohno.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 313-319, 1969. 7 p, 5 fig, 8 ref.

Descriptors: *Equations, *Hydraulic jump, *Mathematical models, Simulation analysis, Mathematical studies, Continuity equation, Transition flow, Surges, Standing waves, Open channel flow.
Identifiers: Boussinesq equation.

For hydraulic jumps of short wave length and nearly-horizontal flow, depths and velocities can only be given their mean values, and calculation schemes that are not amplitude-dissipative can be used. Such schemes are 'non-linearly dissipative' in that their properties cannot be calculated by Fourier representation, but have more tendency towards consistency with the Boussinesq equation. (Knapp-USGS)
W71-01225

HYDRAULIC CHARACTERISTICS OF TSUNAMI ACTING ON DIKES,
Ministry of Agriculture and Forestry, Yawata (Japan). Agricultural Engineering Research Station.
Makoto Nakamura, Hidehiko Shiraishi, and Yasuo Sasaki.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 45-59, 1969. 15 p, 13 fig.

Descriptors: *Tsunamis, *Bores, *Waves (Water), *Dikes, Ocean waves, Hydraulic models, Floods, Seiches, Flood control, Hydraulic structures, Shore protection.
Identifiers: Japan, Wave forces.

In the vicinity of shore lines, concentration of energy makes tsunami height very large. Tsunami can be classified into two types, i.e. the 'Seiche type' in which energy is conserved in great height duplicated by seiche motion and the 'Progressive breaker type' in which the tsunami progresses in the form of a bore. This paper presents the conventional formulas and necessary data to estimate the tsunami pressure acting on a dike, the tsunami height, the tsunami run-up on a dike and the quantity of overflow discharge across a dike crown. The type of tsunami used in a hydraulic model was the progressive breaker type in which tsunami have the strongest destructive power against shore land. This model study was confirmed by study of the Tokachi-oki Earthquake tsunami, which attacked the northeastern coast of Japan in May 1968. (Knapp-USGS)
W71-01243

STANDING LONG WAVES OF FINITE AMPLITUDE,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
Nobuo Shuto.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 13-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 77-84, 1969. 8 p, 1 tab, 1 ref.

Descriptors: *Waves (Water), *Standing waves, *Mathematical studies, Ocean waves, Shore protection, Mathematical models.
Identifiers: Standing long waves.

The problem of standing long waves of finite amplitude is analyzed. When the relative depth d/L is smaller than about 0.15, the accuracy of solutions of standing surface waves is not satisfactory. The perturbation method with respect to the relative depth gives more accurate results. The problem may be reduced to that of the interaction of waves with conic-section forms. Physical quantities such as surface elevation, water particle velocities, wave velocity and wave pressure are given, up to the second order of approximation, by using the Jacobian elliptic functions and the Zeta-function. (Knapp-USGS)
W71-01246

ON THE EFFECT OF OFUNATO TSUNAMI-BREAKWATER AGAINST 1968 TSUNAMI,
Ministry of Transportation, Yokosuka (Japan). Port and Harbour Research Inst.
Yoshiyuki Ito.
French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 85-93, 1969. 9 p, 5 fig.

Descriptors: *Tsunamis, *Harbors, *Shore protection, *Mathematical models, Waves (Water), Floods, Water level fluctuations, Data collections, Profiles, Coastal structures.
Identifiers: Wave recorders, Japan.

The construction of tsunami-breakwater in Ofunato Harbour, Japan was proposed after Chilean Earthquake Tsunami in 1960. The effect of breakwaters against tsunami was studied by numerical calculations. In May 1968, this tsunami breakwater experienced the first tsunami since its completion in 1967. Water level elevations were obtained by two recorders, outside and inside the breakwater. The incident tsunami profile was calculated and compared with observations at the outside recorder. Then, after confirming a good agreement between calculation and observation at the inside recorder, the water level and velocity distribution was computed for the harbor before the construction of the breakwater. Thus, the effect of the existing breakwater was definitely estimated. If no breakwater had been constructed in this harbor, the highest water level would have been increased to almost twice the actual one. (Knapp-USGS)
W71-01247

THE INFLUENCE OF FRICTION ON THE PROPAGATION OF TIDES (FRENCH),
Politecnico di Torino (Italy). Inst. of Hydraulics and Hydraulic Construction.
For primary bibliographic entry see Field 02L.
W71-01248

A NUMERICAL MODEL OF A WIDE SHALLOW ESTUARY,
For primary bibliographic entry see Field 02L.
W71-01250

TRANSFORMATION AND RUN-UP OF TSUNAMI TYPE WAVE TRAINS ON A SLOPING BEACH,
Tetra Tech, Inc., Pasadena, Calif.
Li-San Hwang, Samuel Fersht, and Bernard Le Mehaute.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 131-140, 1969. 10 p, 7 fig, 10 ref. AEC Contract No AT (26-1)-289.

Descriptors: *Tsunamis, *Waves (Water), *Ocean waves, *Surf, *Beaches, Frequency analysis, Equations, Mathematical models, Mathematical studies, Coastal engineering, Beach erosion, Shore protection, Flood protection.
Identifiers: Wave run-up (Beaches).

The problem of transformation of non-periodic wave trains from a surface deformation on a uniform sloping beach was analyzed based on nonlinear shallow water wave equations. Numerical results were obtained for various locations on the sloping beach as well as at the shoreline. These calculations indicate the existence of a strong beating phenomenon of a lower frequency than that of the incident wave. This is due to the interaction between the incident and the reflected waves from the sloping beach. The intensity of the beating phenomenon decreases toward the shoreline, and vanishes at the shore. Numerical calculations of nonlinear effects on the wave profile and wave breaking are presented and discussed. Experimental results are introduced and compared. (Knapp-USGS)
W71-01259

TURBULENT DISPERSION IN PERIODIC FLOW,
Kyushu Univ., Fujuoka (Japan). Dept. of Hydraulic Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01261

FLOW IN CONDUITS WITH LOW ROUGHNESS CONCENTRATION,
Washington State Univ., Pullman.
J. A. Roberson, and C. K. Chen.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY4, p 941-957, Apr 1970. 17 p, 12 fig, 12 ref, 3 append.

Descriptors: Conduits, Drag, *Fluid flow, Fluid mechanics, Fluid friction, Hydraulics, *Flow resistance, *Pipe flow, Reynolds number, Roughness coefficient, *Roughness (Hydraulic), Turbulent flow, Equations, Velocity distribution, Bibliographies, Aanalytical techniques.
Identifiers: Shear distribution, Surface resistance, Drag-force.

The ultimate objective in the analytical study of flow in rough conduits is the ability to predict the resistance to flow as a function of the geometric characteristics of the conduit surface, the fluid properties, and the rate of flow. A procedure for obtaining overall resistance for flow in conduits roughened with discrete geometric elements is presented. The basic laws for turbulent flow in conduits and the relationship between the drag of blunt bodies and the velocity of flow past the bodies were utilized to obtain transition functions that relate the friction factor and relative roughness to the Reynolds number. Solutions are presented for boundaries roughened with cubes and spheres. Results are generally consistent with experimental results obtained by Koloseus, O'Loughlin, and Schlichting. (USBR)
W71-01304

FLOW OVER ROUND CRESTED WEIRS,
Chile Univ., Santiago.
S. Montes.
L'Energi Electtrica, Vol 47, p 155-164, Mar 1970. 10 p, 11 fig, 2 tab, 21 ref.

Descriptors: *Weirs, Hydraulic design, Hydraulic structures, *Fluid flow, Hydraulic engineering, *Discharge measurement, Bibliographies, Discharge coefficients, Experimental data, Pressure distribution, Nappe, Velocity, Sharp crested weirs.
Identifiers: *Round-crested weirs, Boundary conditions.

Round-crested weirs represent an important part of the structures used in hydraulic engineering. The well-known family of so-called Creager profiles belongs in this category. Numerous applications of round-crested weirs are available for determining discharge for hydrological, agricultural, and industrial purposes. The use of round-crested weirs in the laboratory has certain advantages over the sharp-crested variety, especially for very small heads. The slightly larger coefficient of discharge of round-crested weirs may be advantageous. A method of predicting discharge coefficients, velocities, and pressure distribution over the crest section for round-crested weirs is offered. The method is based on certain published principles that in theory were not developed sufficiently for practical use. The author has endeavored to overcome this defect. Has 21 references. (USBR)
W71-01314

FLOW DISTRIBUTION IN STREET INTERSECTIONS AS DETERMINED BY EXPERIMENTAL HYDRAULIC MODEL STUDIES.
Los Angeles Bureau of Engineering, Calif. Storm Drain Div.
For primary bibliographic entry see Field 02E.
W71-01334

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics, Inc., Laurel, Md.
W. T. Lindenmuth, O. J. Scherer, and P. Van Dyke.
Available from NTIS as AD-702 512, $3.00 in paper copy, $0.95 in microfiche. Technical Report 948-1 (I), January 1970, various pagings. 5 ref. Contract DOT-CG-93907-A.

Identifiers: *Water pollution, Control systems, *Petroleum, Water pollution, *Floating bodies, Performance (Engineering), Motion, Mathematical analysis, Cylindrical bodies, Loading (Mechanics), Wind, Ocean currents, Force (Mechanics), Ocean waves, Programming (Computers), Configuration, Model tests, Curve fitting, *Oil retention booms, *Oil spills.

A theoretical analysis of the loads and motions of a continuous, elastic, oil retention boom of arbitrary configuration is presented. The boom is subjected to loads of wind, current, and an irregular sea. The analytical method was programmed for computer and used to generate data for a variety of oil booms. Towing tank tests were conducted on selected boom configurations and serve to check the theoretical analysis.
W71-01527

HYDRAULICS OF LOW-GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 02G.
W71-01545

8C. Hydraulic Machinery

HYDRAULIC MODEL STUDIES OF AN ENERGY DISSIPATOR FOR A FIXED CONE VALVE AT THE UTE DAM OUTLET WORKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08A.
W71-01142

RESEARCH NEEDS IN THE CIVIL ENGINEERING ASPECTS OF POWER.

Proc Amer Soc Civ Eng, J Power Div, Vol 96, No PO2, p 187-276, Feb 1970. 90 p, 4 tab, 83 ref, 3 append.

Descriptors: *Civil engineering, *Research and development, Safety, Air pollution, *Electric power production, Pumped storage, Pollutants, Waste disposal, Water pollution, Hydroelectric power, Water quality, Optimum development plans, Resource development, Nuclear powerplants, Bibliographies, Laboratory tests, Test facilities, Thermal power, Fuels.
Identifiers: Air pollution control, Nuclear power.

Research needs in the civil engineering aspects of power are reviewed and cataloged in a report developed by the Power Division Research Committee of the American Society of Civil Engineers and presented in panel meetings at a Specialty Conference at the University of Washington, Pullman, in Sept 1968. The panel reports cover optimal development of resources, fuels and air quality control, water quality control, use and disposal of wastes, safety and security of powerplants, pumped storage, and test facilities. Three appendices present abstracts of the luncheon speeches, the program of events and presentations, and a list of attendees and contributors. (USBR)
W71-01318

GENERAL SURVEY OF HVDC PROJECTS,
Central Electricity Generating Board (England)
C. C. Tam.
Direct Curr, Vol 1, No 4, p 128-132, 1970. 5 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Direct current, Extra high voltage, Foreign countries, *Transmission (Electrical), *Reviews, *Extra long distance, Histograms, Hydroelectric power, Research and development, Converters (Electrical), Electric power production.
Identifiers: *High voltage, Installed capacity, Great Britain, France, Sweden, Canada, Power losses, Japan, USSR, Thyristors.

A world survey of hvdc in electric power transmission includes projects built since 1954 and those proposed through 1980. Critical views are given of different technical possibilities and the commercial aspects of hvdc transmission. During the first 15 yr, the rating of mercury arc valves has increased from 20 mw (Gotland) to 270 mw (Nelson River) and the application has become worldwide. By 1980, the highest rated scheme (Ekibastuz, USSR) will be 300 times that of the Gotland scheme. During 1960-69, the rate of installation of hvdc schemes was nearly one each year. For 1970-79, present information suggests about the same rate of installation, but the total installed capacity will increase more than 5 times. A comprehensive table including details of all existing projects, a histogram, and a graph of the growth of transmitted capacity by hvdc up to 1980 are given. (USBR)
W71-01388

8D. Soil Mechanics

SOME DESIGN CONSIDERATIONS IN THE SELECTION OF UNDERGROUND SUPPORT SYSTEMS,
Illinois Univ., Urbana. Dept. of Divil Engineering.
R. B. Peck, D. U. Deere, J. E. Monsees, H. W. Parker, and B. Schmidt.
Available from NTIS as PB-190 443, $3.00 in paper copy, $0.95 in microfiche. Various pagings, November 1969. DOT Contract No 3-0152.
Identifiers: *Underground structures, Design, *Supports, Anomalies, Soil mechanics, Water, Underground, Rock (Geology), Soils, Reinforcing materials, Costs, Earthmoving equipment, Decision making, Cost effectiveness, *Tunnels.

Guidelines for the design of supports for underground openings in both soil and rock are presented and discussed for several specific situations. The design and construction of both shafts and tunnels are examined. The problems that may occur because of unusual or variable geologic conditions are outlined and the effects of these geologic anomalies on the construction scheme are indicated. Other situations considered include multiple parallel tunnels and crossed tunnels as well as intersections and enlargements of tunnels. Support systems and construction methods which can be easily modified to adapt to variable conditions and requirements are also discussed. The cost of tunnel support systems is evaluated and compared to the total cost of the tunnel. The cost relationships are illustrated by numerous detailed cost estimates of tunnels in both soil and rock. Finally, the problems of ground movements around soft ground tunnels are discussed and methods for predicting the magnitude of settlement over soft ground tunnels are presented.
W71-01145

LOCATING AND TRACING SEEPAGE WATER IN UNSTABLE SLOPES,
Kentucky Dept. of Highways, Lexington. Div. of Research.
Yasin A. Alkhoja, and Gordon D. Scott.
Available from NTIS as PB-190 620, $3.00 in paper copy, $0.95 in microfiche. February 20, 1970. 38 p.
Identifiers: *Pavements, Foundations (Structures), *Terrain, Stabilization, *Soils, Drainage, Avalanches, Shear stresses, Failure (Mechanics), Costs, Effectiveness, Tracer studies, Dyes, Detection, Resistance (Electrical), Kentucky, Embankments, Groundwater.

The objective of the study was the development of a practical method of locating and tracing seepage water in unstable slopes. The study consisted of testing several methods at side-hill fill locations where the highway was distressed. In each case, construction of the fill had blocked drainage. The results of the study indicate the following: Clean, fine sand did not remove fluorescent dye from solution for moderate percolation distances, but the dye became somewhat less detectable due to its absorption by the sand for longer percolation distances. The conventional monitoring equipment (ultraviolet light) was not sufficiently efficient to monitor low concentrations of the dye. The tracer method was not dependable for the purpose of locating seepage waters and was shown to require further improvement. However, it was used to verify a suspected source of seepage when the groundwater was believed to have traveled through defined channels or very porous material. The water table observation method was the most definitive and useful of the methods studied for tracing and locating seepage water. The electrical resistivity method did not yield very accurate and dependable results without correlation with actual site moisture conditions. With more and better selection of sampling holes and resistivity observations, more useful results could be obtained from this method.
W71-01146

IN SITU STRENGTH OF ROLLED AND HYDRAULIC FILL,
National Building Research Inst., Pretoria (South Africa).
G. E. Blight.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM3, p 881-899, May 1970. 19 p, 11 fig, 23 ref, append.

Descriptors: *Hydraulic fills, *Rolled fills, *Compaction, *Earth dams, Fills, *Shear strength, Anisotropy, Soil mechanics, Vane shear tests, Embankments, *Slope stability, Gypsum, Fly ash, Mine wastes, Bibliographies, Isotropy.
Identifiers: Tailings.

Rolled and hydraulic fill usually have anisotropic in situ strength characteristics. The strengths on horizontal and vertical planes in an anisotropic soil may be evaluated by vane shear tests with vanes of different shapes. Tests show that in situ strength of recently compacted fill is anisotropic because of in-place stress conditions, although the soil is intrinsically isotropic. In a 34-year old embankment tested, however, in situ strength was isotropic although the soil was intrinsically anisotropic. In situ strength of hydraulic fill is anisotropic in such a way as to correspond to K sub O consolidation. After construction, stresses in a compacted embankment are modified by plastic creep of the soil which, in turn, modifies the strength characteristics of the soil. Predicted strengths in a newly compacted fill correspond with the strength on horizontal planes in the embankment. The predicted long-term strength in an embankment agreed with measured in situ strengths below the water table. Above the water table, in situ strength can be enhanced by the effects of evaporation from the surface of the embankment. Has 23 references. (USBR)
W71-01301

THE OPTIMUM GRAVITY DAM,
California Univ., Berkeley.
For primary bibliographic entry see Field 08A.
W71-01306

DERWENT DAM--DESIGN CONSIDERATIONS--CONSTRUCTION--EMBANKMENT STABILITY AND DISPLACEMENTS,
Sunderland and South Shields Water Co.; and Manchester Univ. (England).
N. J. Ruffle, N. Buchanan, and P. W. Rowe.
Inst Civ Eng Proc, Vol 45, p 381-452, Mar 1970. 72 p, 53 fig, 8 tab, 28 ref, 2 append.

Descriptors: Foreign construction, Bibliographies, *Dam construction, Dams, *Dam design, Dam foundations, *Earth dams, Cutoffs, Sand drains, Foundation investigations, Engineering geology, Vertical drains, Relief wells, Grouting, Dewatering, Pervious blankets, Borrow areas, Stability analysis, Slope protection, Instrumentation, Soil properties, Soil tests.
Identifiers: Great Britain, Dam stability, Seepage control, Pumping tests, Design modifications, Construction control, Derwent Dam, Gt Brit.

Derwent Dam is a 3000-ft-long, 119-ft-high earth dam on the Derwent River in Great Britain. Three papers describe: (1) the design and changes during construction of the cutoff and embankment; (2) the strengthening of a weak foundation by installing 4475 vertical sand drains, changed construction caused by elimination of a concrete cutoff under the central section of the dam, details about placing and testing various materials, construction and performance of an extensive system of measuring devices, and original cost estimates and final payments; and (3) a critical examination of results of conventional site investigation and laboratory testing procedures in light of performance of a large earth dam on a deep, soft clay foundation and stability, performance, and engineering properties of the foundation and fill. Close achievement of design objectives for the embankment shows that the behavior of sft foundation soils can be predicted and controlled, provided attention is given to the detailed geological features. Has 28 references. (USBR)
W71-01312

EFFECT OF A POLYMER ON THE PROPERTIES OF SOIL-CEMENT,
Bureau of Reclamation, Denver, Colo.
C. W. Jones.
Bureau of Reclamation Report REC-OCE-70-18, May 1970. 11 p, 6 fig, 7 tab, 2 ref.

Descriptors: *Soil cement, *Polymers, Soil compaction, Soil tests, Soil physical properties, Soil stabilization, Permeability, Cements, Unconfined compression, Impregnation, Compressive strength, Soil strength, Canal linings, Riprap, Cracking, Freeze-thaw tests.
Identifiers: Methyl methacrylate, Vinyl acetate, Acetates, Polymer concretes, *Concrete-polymer materials, Polymerization.

A laboratory testing program was conducted on soil-cement specimens of silty sand and of silt with the monomer methyl methacrylate (MMA) added and polymerized. The purpose was to determine any beneficial effects on the properties of soil-cement as used in Bureau of Reclamation construction. By the preformed method, some specimens were impregnated with MMA and polymerization was by gamma radiation from Cobalt 60. Other specimens by the premix method had 3% or 6% MMA with 1% benzoil peroxide as a catalyst incorporated during specimen preparation; polymerization was by heat. The compressive strength of the preformed specimens containing silty sand was increased about 3.4 times that of specimens without MMA, but the premix specimens did not increase in strength. Results of freeze-thaw tests did not show conclusive trends, but there were indications of improvement with the addition of MMA. The MMA reduced significantly the permeability of the silty sand specimens. Petrographic examinations showed that the MMA penetration and filled the voids of portions of the silty sand specimens, but the voids in the silt specimens were nearly empty. (USBR)
W71-01317

DEVELOPMENT OF FAILURE AROUND EXCAVATED SLOPES,
California Univ., Berkeley.
P. Dunlop, and J. M. Duncan.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 471-493, Mar 1970. 23 p, 22 fig, 1 tab, 17 ref, 2 append.

Descriptors: *Slopes, Clays, Overconsolidation, *Excavation, Failure (Mechanics), Stability, Stress distribution, Analysis, Shear strength, Stress-strain curves, Theoretical analysis, Bibliographies, *Slope stability.
Identifiers: *Finite element method.

Nonlinear analyses of stresses around slopes excavated in clay, performed using the finite element method, have been used to determine where failure begins and how the failure zone enlarges as excavation continues. The stress-strain and strength

characteristics are represented in the analyses by stress-strain curves consisting of 2 straight lines, and the analyses are conducted in a series of increments simulating successive stahesges of excavation. Results show that the location of the first failure and the manner in which the failure zone enlarges depend on the initial stress conditions before excavation and the manner in which the shear strength of the clay varies with depth. The analysis indicate that the development of failure around slopes excavated in overconsolidated clay is considerably different from the development of failure around slopes in normally consolidated clay. (USBR)
W71-01320

METHOD FOR PREDICTING INITIAL SETTLEMENT,
Massachusetts Inst. of Tech., Cambridge.
D. J. D'Appolonia, and T. W. Lambe.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 523-544, Mar 1970. 22 p, 16 fig, 2 tab, 22 ref, 2 append.

Descriptors: Clays, Theory, Strain, Anisotrophy, Shear strength, Stress-strain curves, Laboratory tests, Stiffness, Bibliographies, Theoretical analysis, *Settlement, *Settlement (Structural), Soil mechanics, Stress.
Identifiers: Stress paths, Finite element method, Soil modulus, Boundary conditions, Undrained shear strength.

A method of analysis is developed for predicting initial settlement caused by strains that occur within soil that remains at constant volume. The method employs finite element analysis and includes: (1) stress and displacement boundary conditions; (2) soil nonlinearity, nonhomogeneity, and anisotropy; and (3) initial gravity stress in the soil. A sample problem is used as a vehicle for indicating qualitatively the importance of initial anisotropic gravity stresses and undrained strength anisotropy with rotation of principal planes to settlement prediction and actual settlement behavior. Also considered is the sensitivity of load-deformation predictions to uncertainties in soil modulus and shear strength. The load-settlement behavior of a footing on clay depends on the stress-strain modulus and the initial state of stress in the soil. The soil modulus in laboratory tests is subject to major uncertainties. (USBR)
W71-01321

SAFETY ANALYSIS OF SLOPES,
Ohio State Univ., Columbus.
T. H. Wu, and L. M. Kraft, Jr.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 609-630, Mar 1970. 22 p, 12 fig, 4 tab, 40 ref, 3 append.
Identifiers: *Slopes, Stability, Analysis, *Safety factors, Economics, Statistical analysis, Errors, Bibliographies, *Slope stability, Costs, Soil properties.

Research on soil properties and analysis of slope stability have thrown light on the uncertainties and errors of many assumptions commonly adopted in practice. The study considers a problem in slope stability that is designed by a set of procedures deemed representative of current practice, and called conventional practice. Various uncertainties and errors are evaluated from published research results, and are used to compute the failure probability of slopes designed according to conventional practice. Statistical decision theory is used to obtain the optimum safety factor and the expected cost. Results also show the effect of uncertainties on the optimum design and the expected cost. The study illustrates one approach in the application of research results to practice and the evaluation of benefits gained from research. (USBR)
W71-01322

SEISMIC RESPONSE OF SOIL DEPOSITS,
Woodward-Clyde and Associates, Oakland, Calif; and California Univ., Berkeley.
I. M. Idriss, and H. B. Seed.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 631-638, Mar 1970. 8 p, 6 fig, 12 ref, 2 append.

Descriptors: *Seismic investigations, *Damping, Elasticity modulus, Analysis, Theoretical analysis, Seismic studies, Seismic waves, Soil mechanics, *Soil investigations, Soil properties.
Identifiers: Site selection, Seismic tests, Seismic prospecting, *Soil deposits, Soil modulus.

An analytical procedure for evaluating the seismic response of horizontal soil layers incorporating equivalent linear moduli and damping ratios varying with depth is presented. The use of this procedure is illustrated and results are compared to recorded values and to computed values using a constant damping solution. The comparisons indicate that the variable damping solution often provides response values that are in better agreement with recorded values than those obtained from a constant damping solution. The difference does not appear to be great when the deposit consists of soils that are essentially similar; much greater differences are obtained when the deposit consists of sublayers that vary greatly. (USBR)
W71-01323

EMERGENCY MEASURES AT LLUEST WEN RESERVOIR,
D. G. Gamblin, and A. L. Little.
Water and Water Engineering, Vol 74, No 889, p 93-101, Mar 1970. 9 p, 4 fig, 6 photo, append.

Descriptors: *Earth dams, *Dam failure, Pumping, Inspection, Grouting, Safety, Froeign countries, Sinkholes, Subsidence, Reservoirs, Repairing, Seepage, Leakage, Reservoir leakage, Drawdown, Outlet works.
Identifiers: Piping (Erosion), *Remedial treatment, Great Britain.

Lluest Wen Dam in Great Britain consists of a 70-ft-high, puddle clay core earth embankment; a 110-ft-wide overflow spillway; and outlet works. The outlet works include a 15-in.-dia water supply main supplied by a wet and dry chamber and valve shaft arrangement containing sluice valves at different levels to a 15-in.-dia vertical stand pipe. The water supply main and a 6-in.-dia shaft drainpipe pass through the puddle core and into a tunnel under the downstream shoulder of the dam. A large hole was discovered in the embankment upstream from the puddle core near the valve shaft. Inspections revealed a break in the 6-in. drainpipe near the center of the puddle core and clay in the drainage water. The 15-in.-dia outlet pipe was inadequate for lowering the reservoir water surface. Emergency operations to lower the water surface under difficult weather and access conditions by pumping, lowering the spillway elevation, and diverting inflow into an unmaintained bypass channel are described. Temporary remedial construction was to lower the reservoir water surface and spillway elevation by 30 ft, grout in the area of the valve shaft, concrete line the spillway channel, and repair the reservoir inflow bypass channel. (USBR)
W71-01381

A FINITE ELEMENT APPROACH TO ELASTIC SOIL-STRUCTURE INTERACTION,
Manchester Univ. (England).
Ian M. Smith.
Can Geotech J, Vol 7, No 2, p 95-105, May 1970. 11 p, 15 fig, 5 tab, 18 ref.

Descriptors: Elastic deformation, *Foundations, Footings, Deflection, Cohesionless soils, Structures, *Soil mechanics, Soil pressure, Pressure distribution, Correlation techniques, Bibliographies, Foreign research, Theoretical analysis.

An application of the displacement finite element method to axisymmetric soil-structure interaction problems is described. Because the structure and foundation are analyzed as an entity, the distribution of contact pressure does not have to be assumed. The accuracy of the method is first assessed in the analysis of some simple problems to which other solutions exist. Then a series of laboratory results and one field case record, all involving flexible structures bearing on cohesionless foundations, are analyzed, the foundations being treated as elastic but inhomogeneous. Winkler and elastic solid foundations are considered. For elastic solid foundations, physically reasonable distributions of the elastic modulus do not lead to very good predictions of the deflections of the structure, although the deflections within the foundation agree with observed values. (USBR)
W71-01392

8E. Rock Mechanics and Geology

SOME DESIGN CONSIDERATIONS IN THE SELECTION OF UNDERGROUND SUPPORT SYSTEMS,
Illinois Univ., Urbana. Dept. of Divil Engineering.
For primary bibliographic entry see Field 08D.
W71-01145

RESERVOIR RIM STABILITY - LAKE ROOSEVELT. COLUMBIA BASIN PROJECT.
Bureau of Reclamation, Denver, Colo.

Available from NTIS as PB-193 524, $3.00 in paper copy, $0.95 in microfiche. November 1969. 24 p.
Identifiers: *Lakes, *Avalanches, Photographs, Erosion, Hazards, Clay, Silt, Sand, Washington (State), Dams, Stabilization, Lake Roosevelt, Columbia Basin Project, *Reservoirs, *Banks (Waterways), *Landslides.

Lake Roosevelt first reached its maximum elevation of 1290 feet above sea level on July 15, 1942 following the completion of Grand Coulee Dam in 1941. In 1968 water requirements downstream and needs for power generation resulted in a drawdown to about elevation 1200. In the spring of 1969 construction of the Third Powerplant at Coulee Dam required a maximum drawdown to elevation 1160. The drawdown was below elevation 1170 for six weeks. A similar drawdown is planned for 1973. Several factors have caused increased activity in landslide surveillance in recent years. Historically, the river valley has been subject to extensive degradation due to landslide activity. The large drawdowns of 1968, 1969, and 1970, the increased use of the lake area for recreation, industry, farming, and municipal growth, and a major slide in 1969 now warrant a closer look at the potentially increased hazards and problems. The purpose of the report is to briefly review the landslide and regression problems and to describe management's efforts to maximize the use of the lake resource and at the same time reduce hazards and encroachments to a minimum with a more progressive acquisition program.
W71-01154

SPECTRAL SIMULATION AND EARTHQUAKE SITE PROPERTIES,
Bell Telephone Labs., Inc., Whippany, N.J.
S. C. Liu, and D. P. Jhaveri.
Proc Amer Soc Civ Eng, J Eng Mech Div, Vol 95, No EM5, p 1145-1168, Oct 1969. 24 p, 15 fig, 3 tab, 8 ref, 2 append.

Descriptors: *Earthquakes, Models, Statistical analysis, Theoretical analysis, *Seismic investigations, Damping, Seismic studies, *Earthquake engineering, Seismic design.

Analytic results of studies on site properties and use in ground motion prediction and simulation are presented. Spectral simulations of random-type ground motions based on modal contributions are formulated. Linear filters representing ground transfer characteristics of seismic stations are investigated. Single-mode and 2-mode stochastic

models are developed to permit prediction of random-type ground motions and the induced response statistics of structures. From the viewpoint of stochastic simulation, the autocorrelation function or the power spectral density function derived from the record accelerogram can be used to characterize the specific ground motion. By matching the power spectral density function of an existing ground motion record to that of the appropriate output of a linear single- or multi--degree-of-freedom system subject to white noise, predominant modal ground frequencies and dampings can be determined. (USBR)
W71-01319

8F. Concrete

FAILURE STUDY OF AN OVERLOADED 96 IN. CONCRETE PIPE,
California State Div. of Highways. Materials and Research Dept.
For primary bibliographic entry see Field 08A.
W71-01120

ALPE GERA DAM,
For primary bibliographic entry see Field 08A.
W71-01305

SMALL CONCRETE SPECIMENS UNDER REPEATED COMPRESSIVE LOADS BY PULSE VELOCITY TECHNIQUE,
For primary bibliographic entry see Field 07B.
W71-01310

EVALUATING EFFECTIVENESS OF CONCRETE CURING COMPOUNDS,
Pennsylvania State Univ., University Park.
R. E. Carrier, and P. D. Cady.
Journal of Materials, Vol 5, No 2, p 294-302, June 1970. 9 p, 8 fig, 4 ref.

Descriptors: *Curing compounds, Concrete technology, Petrographic investigations, *Relative moisture content, Laboratory tests, Moisture, Membranes, *Highways, Humidity, *Curing.
Identifiers: *Moisture sensors, *Concrete pavements, Cement hydration, Schmidt test hammer, *Curing-effectiveness gage, Concrete slabs.

Use of membrane-forming curing compounds has become a universal practice for concrete paving, but little is known about the effectiveness of varying application rates. Laboratory experiments are described in which slab specimens were cured with application rates varying from no coverage to 100 sq ft/gal in a controlled environment simulating severe summer exposure. As long as a continuous membrane is formed, the rate of application of the curing compound has little effect on curing effectiveness. This observation was supported by Schmidt hammer indications of surface strengths and by petrographic examinations. Beneath 1 in. below the membrane, the hydration process (curing) is sustained throughout the 28-day curing period independent of the thickness of the membrane. The upper 1 in. is of primary importance with respect to riding quality, safety, and aesthetics. To assure that the surface of a concrete pavement is being cured properly, a relative humidity-indicating button has been developed for insertion into fresh pavement surfaces. The device has performed well in laboratory tests and is currently undergoing field tests. (USBR)
W71-01311

PLASTICS IN CONCRETE TECHNOLOGY,
A. Witchlow, T. C. Van Hoorn, and P. E. Davies.
Concrete, Vol 4, No 1, p 12-21, Jan 1970. 10 p, 3 tab, 11 ref, 8 photo.

Descriptors: *Concrete technology, *Polymers, *Epoxy resins, Adhesion, *Plastics, *Resins, *Strength, *Durability, Construction materials, Wear resistance, Hard surfacing, Emulsions, Repairing, Concrete additives, Foreign research, Concretes.
Identifiers: *Polyesters, *Concrete-polymer materials, Bond strength, *Polymer concretes, *Acrylic resins, Surfacing, Great Britain.

Plastic resins are being developed for use with concrete to increase strength and durability. The principal resins used are acrylic, epoxy, polyester, and polyvinyl acetate. Plastic resins are used for joining, improving the bond to and within concrete, and making hard-wearing surfaces. Polyvinyl acetate usually improves the properties of hydraulic binders, but if moisture is to be present for long periods, a copolymer of vinyl acetate and a vinyl ester of versatic acid should be used. Epoxy resins with hardeners are usually used for surface protection or repair. Surfaces must be carefully cleaned of dust, oil, or grease to obtain good adhesion. Epoxies may be used for bonding concrete to metal. A wide variety of resin formulations is available. (USBR)
W71-01383

INFLUENCE OF COMPRESSIVE STRESSES ON FROST RESISTANCE OF CONCRETE,
A. A. Goncharol, and V. S. Gladkov.
Translation of Beton i Zhelezobeton, No 5, p 37-39, 1969. Reclam Transl 825, July 1970. 14 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Freeze-thaw tests, Hydraulic structures, Non-destructive tests, Reinforced concrete, *Concrete technology, Admixtures, Sea water, *Concrete testing, Foreign research, *Durability, Coastal structures, Water level fluctuations, Creep, Deformation, Air entrainment, Concrete additives.
Identifiers: USSR, *Compressive stress, *Frost resistance, Ultrasonic tests, Concrete properties, Spalling, *Freeze-thaw durability.

Durability of modern hydraulic structures subjected to changing water levels and alternate freezing and thawing under significant loading was studied at several Soviet laboratories. In addition to a review of the literature and a study of existing structures, laboratory tests for compressive stress, cracking, and frost resistance were conducted on specimens from 2 concrete mixes that were identical except for special additives to increase frost resistance. Ultrasonic testing was used for investigating cracking and loss of strength; creep deformation was measured by removable deformation gages. Test methods and conditions are described. Conclusions were that: (1) compressive stresses within a specific range will increase frost resistance of concrete without admixtures; (2) increased loads lower frost resistance; and (3) concrete with air-entraining admixtures can tolerate much higher compressive stresses without lowering frost resistance. (USBR)
W71-01393

CONCRETE IN A MARINE ENVIRONMENT.
Texas Transportation Inst., College Station.

Available from NTIS as PB-189 872, $3.00 in paper copy, $0.95 in microfiche Bibliography 1-195, November 1966. 7 p.
Identifiers: *Civil engineering, Concrete, *Concrete, Sea water, Sodium Chloride, Corrosion, Wear resistance, Reinforced concrete, Bibliographies, Abastracts.

The annotated bibliography of 14 items deals with the effect of seawater on reinforced concrete in relation to highway engineering.
W71-01509

8G. Materials

SCALE CONTROL IN HIGH TEMPERATURE DISTILLATION OF SALINE WATER USING FLUIDIZED BED HEAT EXCHANGERS,
Brookhaven National Lab., Upton, N.Y.
For primary bibliographic entry see Field 03A.
W71-01200

ASSEMBLY AND EVALUATION OF AN IMPROVED PPB OXYGEN ANALYZER FOR SEA-WATER,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W71-01201

PLASTICS IN CONCRETE TECHNOLOGY,
For primary bibliographic entry see Field 08F.
W71-01383

8H. Rapid Excavation

RADIOACTIVITY IN WATER: PROJECT RULISON,
Teledyne Isotopes, Palo Alto, Calif.
For primary bibliographic entry see Field 05G.
W71-01136

8I. Fisheries Engineering

IMPORTANCE OF PROVISION WITH FOOD FOR THE SURVIVAL OF FISH LARVAE (ON AN EXAMPLE OF THE BREAM OF RYBINSK RESERVOIR),
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
For primary bibliographic entry see Field 02H.
W71-01506

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

THE NATION'S ENGINEERING RESEARCH NEEDS, 1965-1985.
Engineers Joint Council, New York.
For primary bibliographic entry see Field 06B.
W71-01169

PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970.
Connecticut Univ., Storrs. Inst. of Water Resources.

Available from NTIS as PB-195 667, $3.00 in paper copy, $0.95 in microfiche. William C. Kennard, editor. Connecticut University Institute of Water Resources Report No 13, September 1970. 20 p. OWRR Project A-999-CONN (8).

Descriptors: *Water resources research act, Connecticut, *Universities, *Abstracts, Water pollution treatment, Instrumentation, Waste disposal, Aeration, Erosion control, Water pollution sources, Water law, Algae, Dissolved oxygen.
Identifiers: Water resources research.

These Proceedings include abstracts of papers presented at the Conference held by the Institute of Water Resources at the University of Connecticut on May 18, 1970. The title of each presentation is the same as that of the research project. Also given for each are the personnel, academic departments, planned duration and the objectives of the investigations. Each abstract is a brief summary of accomplishments to date and plans for the future. The program of the Institute has become increasingly diverse in the approximately six years that it has been in existence. Projects in the agricultural, biological, engineering, earth, social and physical sciences have been or now are active. Continued expansion, both in scope of the research and in the number of projects, is planned. The results of these investigations will, in many cases, have direct appli-

cation to solving problems of water resources use and development in Connecticut and will result in important contributions to the fund of scientific information about water in a broad range of disciplines. (Knapp-USGS)
W71-01192

10. SCIENTIFIC AND TECHNICAL INFORMATION

ANNOTATED LIST OF PUBLICATIONS, 1895-1970,
Illinois State Water Survey, Urbana.
J. Loreena Ivens.
Illinois State Water Survey Publication, April 1970. 84 p, 1 map, 2 index.

Descriptors: *Publications, *Bibliographies, *Information retrieval, Water resources, Illinois, Documentation, Hydrology, Hydraulic systems, Water quality, Atmospheric physics.
Identifiers: Water Survey reports, Citations.

This is a very useful historical and current guide of literature issued by the Illinois State Water Survey. Three formal series of publications are issued: Bulletins, Reports of Investigations, and Circulars. A Miscellaneous Publications category includes technical letters and brochures, and a series of Contract Publications are for final reports requested by granting or contracting agencies and published in small quantities primarily for their use. In this booklet publications in each series and group are listed and briefly described starting with the most recent issues. Out-of-print reports are mostly available on a loan basis. This booklet contains 498 items. (Lang-USGS)
W71-01105

EARTH RESOURCES RESEARCH DATA FACILITY INDEX.
National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.
For primary bibliographic entry see Field 07C.
W71-01206

BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH,
Federal Water Quality Administration, College, Alaska. Alaska Water Lab.
For primary bibliographic entry see Field 05D.
W71-01262

PROGRESS IN HEAT TRANSFER - REVIEW OF 1969 LITERATURE,
J. A. R. Henry.
Chemical and Process Engineering - Heat Transfer Survey, 1970, p. 19-26, 162 ref.

Descriptors: *Heat transfer, *Bibliographies, *Reviews, Conduction, Convection, Motivation, Evaporation, Heat exchangers, Condensation, Mathematical models, Reynolds number, Temperature, Mass transfer, Momentum transfer, Boiling, Cooling.
Identifiers: Literature review.

The literature review based on 162 selected papers from 8,000 articles is presented here. The article is divided up under the headings of conduction radiation, convection change of phase, multi-phas flow and heat exchangers. (Novotny-Vanderbilt)
W71-01344

CONCRETE IN A MARINE ENVIRONMENT.
Texas Transportation Inst., College Station.
For primary bibliographic entry see Field 08F.
W71-01509

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

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1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

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FEBRUARY 15, 1971

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SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 4, NUMBER 4
FEBRUARY 15, 1971

W71-01651 -- W71-02200

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

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A. Properties

ODIFIED WATER BY THE CRYOSCOPIC ETHOD.
V. Deryagin, B. V. Zheleznyi, N. N. Zakhavaeva, A. Kiseleva, and A. I. Konovalov.
ans. from Doklady, An SSSR, Ser Khimiya, Vol. 9, No. 4, 5, 6, 1969. Available from NTIS as RS-499 86, $3.00 in paper copy, $0.95 in icrofiche. JPRS (translation) 49986 March 5, 970. 8 p, 9 ref.
entifiers: *Water, Molecular weight, Cryostats, nomalies, Melting, USSR, *Polywater.

lculations have been made from cryoscopic ethods to determine the modecular weight of olywater. Although an exact weight was not deter-ined, the authors roughly calculated its molecular eight to be about 180.
71-01669

NAMALOUS WATER: DISCOVERY OR ER-OR,
Zhvirblis.
ans. from Khimiya: Zhizn, No. 12, p 37-44, 1969. vailable from NTIS as JPRS-500 06, $3.00 in aper copy, $0.95 in microfiche. JPRS (transla-on) 500-06, March 6, 1970. 8 p.
entifiers: *Water, Anomalies, Physical proper-es, Surface tension, USSR, *Polywater.

he report presents a discussion on what is known bout anamalous water (Polywater)
71-01670

STIMATION OF THE MOLECULAR WEIGHT F THE ANOMALOUS COMPONENT OF IODIFIED WATER BY A CRYOSCOPIC IETHOD,
ak Ridge National Lab., Tenn.
V. Deryagin, B. V. Zheleznyi, N. N. Zakhavaeva, A. Kiseleva, and A. I. Konovalov.
ranslated from Dokl. Akad. Nauk SSSR; 189: 282-5 (1969). Available from NTIS as ORNL-tr-301, $3.00 in paper copy, $0.95 in microfiche. RNL-tr-2301, Mar 70. 9 p, 3 fig, 9 ref.
dentifiers: *Water, Weight, Anomalies, USSR, Polywater.

alculations were carried out to permit an estima-on of the molecular weight of polywater. A value f approx. 180 was obtained for average molecular eight.
71-01987

B. Aqueous Solutions and Suspensions

LKALINITY AND FORMATION OF EOLITES IN SALINE ALKALINE LAKES,
Vyoming Univ., Laramie. Dept. of Geology.
or primary bibliographic entry see Field 02H.
71-01903

2. WATER CYCLE

2A. General

EFFECTS OF AREAL AND TIME DISTRIBU-TION OF RAINFALL ON RUNOFF HYDRO-GRAPHS,
Minnesota Univ., Minneapolis. Dept. of Agricul-ural Engineering.
For primary bibliographic entry see Field 02E.
W71-01775

SIMULATION OF RIVER BED VARIATION IN MOUNTAINOUS BASIN,
Osaka Univ. (Japan). Dept. of Civil Engineering.
Akira Murota, and Michio Hashino.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 245-248, 1969. 4 p, 8 fig, 1 ref.

Descriptors: *Sediment transport, *Provenance, *Sediment yield, *Simulation analysis, *Mathematical models, Erosion, Landslides, Rainfall-runoff relationships, Channel morphology, Stochastic processes, Hydrogeology.
Identifiers: Arita River (Japan).

A computer model for analytical calculation of river morphology accounts for the supply of debris products into the river channel. Rainfall is generated by a stochastic model and the resultant streamflows are anlayzed. When rainfall and water storage in the river basin increase so much that the water storage may cause landslides on mountain-sides, debris supply is simulated by a stochastic debris-production model. The rainfall model consists of the frequencies of occurrence, interval, and intensity. The debris-production model is developed from a probability density distribution of debris prducts and a relation between total debris product and water storage, on the assumption of geological homogeneity of the river basin. Simulation is carried out to investigate river bed variation due to rainfall and debris production. Results of simulation are shown for one case of the bed profile after the 1953 disaster in the upper region of the Arita River, Japan. (Knapp-USGS)
W71-01782

ANALYTICAL SOLUTION OF WIENER-HOPF EQUATION FOR RUNOFF PREDICTION,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
Mikio Hino.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 519-524, 1969. 6 p, 2 fig, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Stochastic processes, *Linear programming, Unit hydrographs, Mathematical models, Runoff forecasting, Streamflow forecasting, Optimization.
Identifiers: Wiener-Hopf equation.

The rainfall and runoff process may be considered to be a stationary stochastic process. It may be treated as a linear system, reducing the problem to an integral equation of the Wiener-Hopf type which relates the auto-covariance function of rainfall to the cross-covariance function of rainfall and runoff through the response function (the so-called unit hydrograph in a special case). The rainfall has a very random nature and consequently the auto-covariance of it is approximated simply by an exponential function. The cross-covariance of rainfall and runoff is expressed by the sum of a few terms of the product of exponential and power functions. The coefficients of weighting to be applied to each component are dependent on the ratios of the rainfall period to the periods of runoff components. The more rapidly a runoff component decreases, the lighter the weighting coefficient becomes. Some examples of application of the theory are shown. (Knapp-USGS)
W71-01807

WORLD METEOROLOGICAL ORGANIZATION AND ITS PROGRAMMES IN HYDROMETEOROLOGY AND HYDROLOGY,
World Meteorological Organization, Geneva (Switzerland). Hydrometeorology Div.
For primary bibliographic entry see Field 02B.
W71-01818

HYDROMETEOROLOGICAL STUDIES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
For primary bibliographic entry see Field 02B.
W71-01819

DIGITAL SIMULATION IN HYDROLOGY AND ITS ROLE IN HYDROLOGIC EDUCATION,
Stanford Univ., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-01820

AN ENGINEERING-ORIENTED MODEL OF WATERSHED HYDROLOGY,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
H. N. Holtan, and N. C. Lopez.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 572-604, published by Univ of Illinois, 1969. 33 p, 14 fig, 4 tab, 17 ref.

Descriptors: *International Hydrological Decade, Conferences, *Rainfall-runoff relationships, *Small watersheds, *Agricultural engineering, Water resources development, Forecasting, Hydrology, Hydraulics, Sedimentation, Soil conservation, Surface-groundwater relationships, Planning, Projects, Research facilities, Land development, Hydrogeology, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

In the USDA Hydrograph Laboratory watershed hydrology is organized as a multidisciplinary approach with leadership in (1) meteorology and climate, (2) soils and vegetation, (3) hydraulics, (4) hydrogeology, and (5) watershed hydrologic systems. The mathematical model of watershed hydrology under study in the USDA Hydrograph Laboratory is dedicated to the purposes of agricultural watershed engineering. Major emphasis is on incrementation of the runoff process as prerequisite to watershed changes affecting chronological and spatial sequencing made for engineering purposes. Adistributed system of watershed hydrology is constructed to account for the development of dispersed waters and for their subsequent concentration in channel systems. (Knapp-USGS)
W71-01821

URBAN HYDROLOGY,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 04C.
W71-01822

A SUMMARY OF THE HOPKINS STORM DRAINAGE RESEARCH PROJECT: ITS OBJECTIVES, ITS ACCOMPLISHMENTS, AND ITS RELATION TO FUTURE PROBLEMS IN URBAN HYDROLOGY,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04C.
W71-01823

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES - OPEN CHANNEL EXPANSIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 08B.
W71-01836

TSUNAMI GENERATION,
Tetra Tech, Inc., Pasadena, Calif.
Li-San Hwang, and David Divoky.
Journal of Geophysical Research, Vol 75, No 33, p 6802-6817, November 20, 1970. 16 p, 7 fig, 1 tab, 19 ref. AEC Contract AT (26-1)-289 (006).

Descriptors: *Tsunamis, *Surface water, *Elevation, Mathematical studies, Equations, Earthquakes, Ocean waves, Wave pile-up, Seismic waves, Pacific Ocean.
Identifiers: *Tsunami generation, Ground motion, Elevation change, Seismic sea waves.

The problem of tsunami generation is treated by a numerical method utilizing the governing hydrodynamic equations of motion and continuity and a time-dependent description of bottom motion. The ground-motion model preserves the essential features of a real seismic event, including both horizontal rupture and vertical displacement with associated time scales. The vertical bottom displacement is coupled through the continuity equation to surface water elevation, and a finite difference scheme follows the development of the wave system. An example, the Alaskan Good Friday earthquake of 1964, is shown in some detail, and computations are compared with observations. The approach appears to be capable of accurate description of tsunami generation, limited only by uncertainties in tectonic input. It is also capable of accurate propagation calculations, limited by computer size. (Woodard-USGS)
W71-01908

THE WATER STRUCTURE UNDER A GROWING SEA ICE SHEET,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 02C.
W71-01909

AN EVALUATION OF STREAMFLOW TIMING FROM SMALL WATERSHED IN NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. School of Forest Resources; and Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02E.
W71-01917

CALIBRATION ANALYSIS OF THE THREE LEADING RIDGE EXPERIMENTAL WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
For primary bibliographic entry see Field 02E.
W71-01918

2B. Precipitation

LARGE SCALE DYNAMIC EFFECTS OF CLOUD SEEDING,
Aerometric Research, Inc., Goleta, Calif.
For primary bibliographic entry see Field 03B.
W71-01672

WORLD METEOROLOGICAL ORGANIZATION AND ITS PROGRAMMES IN HYDROMETEOROLOGY AND HYDROLOGY,
World Meteorological Organization, Geneva (Switzerland). Hydrometeorology Div.
Jaromir Nemec.
In: The Progress of Hydrology, Vol 2-Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 512-520, published by Univ of Illinois, 1969. 9 p, 23 ref.

Descriptors: *International Hydrological Decade, Conferences, *Meteorology, *Rainfall-runoff relationships, Network design, Flood forecasting, Research and development, Water resources development, Forecasting, Hydrology, Hydraulics, Data collections, Data processing, Hydrologic data, Education, Research facilities, Exploration, Laboratories, Model studies, Technology, Computers.
Identifiers: *Water resources research, *World Meteorological Organization.

WMO's involvement in hydrology is fairly extensive and is concentrated on the operational aspects of surface water hydrology, including precipitation, snow cover, water level of lakes and streams, streamflow and storage, evaporation and evapotranspiration, soil moisture, relation of groundwater to surface water, water temperature, sediment discharge, river and lake ice, and chemical quality of water. In view of its experience in, and the close relationship between, meteorology and hydrology, the following fields are considered to be WMO's main responsibilities in hydrology: (a) the operational aspects of the collection, transmission, processing and publication of hydrological data; (b) research, development, improvement and promotion of methods, procedures and techniques in the design of networks, standardization of instruments and methods of observation, the operational phases of hydrological forecasting, and the supply of meteorological and related hydrological data for the design of projects. (Knapp-USGS)
W71-01818

HYDROMETEOROLOGICAL STUDIES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
John F. Miller.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 521-562, published by Univ. of Illinois, 1969. 42 p, 5 fig, 42 ref.

Descriptors: *International Hydrological Decade, Conferences, *Meteorology, *Design storm, *Probable maximum precipitation, Research and development, Water resources development, Forecasting, Synoptic analysis, Streamflow forecasting, Flood forecasting, Design flood, Hydrology, Mathematical models, Frequency analysis, Planning, Projects, Research facilities, Rainfall-runoff relationships, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

For basins where streamflow data are not available or of insufficient length to provide adequate estimates of values for even the shorter return periods, it is necessary to develop substitute procedures. Such procedures can be a generalization or regional study of peak flows, frequency analysis of nearby streamflow data and adjustment to the point of interest, synthesis of frequency data based on precipitation-frequency studies, and or determination of the design flood based upon meteorological estimation of the Probable Maximum Precipitation (PMP). The historical development of design flood and PMP procedures and a brief summary of the techniques involved in these studies is discussed. (Knapp-USGS)
W71-01819

CONFIDENCE LIMITS FOR SEASONAL RAINFALL: THEIR VALUE IN KENYA AGRICULTURE,
East African Agriculture and Forestry Research Organization, Mugaga (Kenya).
T. Woodhead.
Experimental Agriculture, Vol 6, No 2, April 1970, p 81-86. 2 tab, 11 ref.

Descriptors: *Rainfall disposition, Rain gages, Water balance, Water requirements, Probable maximum precipitation, Economic feasibility, Farm management.
Identifiers: *Mugaga, Machakos, Kitale, Kenya, East African Meteorological Department.

In order to plan for the efficient use of land and water resources and to determine specific crop feasibilities, a prediction of rainfall in the area is a desirable factor to consider. In three different areas in Kenya a comparison was made between 20 day confidence limits (prediction) and actual rainfall. Although mathematical calculations, logarithmic transformation of skew rainfall data, were able to predict twenty-day rainfall totals, seasonal predictions were not as reliable. The author attempted to add together twenty day confidence limits to determine the seasonal rainfall expectation. However, it was found that rainfall variability is not as extreme during an actual season as it is during a twenty day period. (Holmes-Rutgers)
W71-02099

2C. Snow, Ice, and Frost

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME I,
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.
Robert E. Frost.
Available from NTIS as AD-703 359, $3.00 in paper copy, $0.95 in microfiche. September 1950. 50 p, 94 fig.
Identifiers: *Terrain, Aerial reconnaissance, *Construction, Alaska, *Soils, Permafrost, Aerial photographs, Landing fields, Seacoast, Drainage, Erosion, Photointerpretation, Rivers, Plants (Botany), Colors, Rock (Geology), Ice, Photographic tone, Trafficability, Site selection, Cold weather construction, and forms, Remote areas.

The report presents the results of one phase of the investigation of airfield construction in arctic and subarctic regions being conducted by the St. Paul District, Corps of Engineers, Department of the Army. The overall investigation has as its objective the determination of design criteria and construction methods for areas of permanently frozen ground. The objective of this phase of the investigation has been the development of a technique whereby engineering soils and permafrost conditions could be evaluated from aerial photographs. (See also W71-01666)
W71-01665

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME II.
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.

Available from NTIS as AD-703 343, $3.00 in paper copy, $0.95 in microfiche. September 1950. 112 p, 98 fig, 207 ref.
Identifiers: *Terrain, Aerial reconnaissance, *Construction, Alaska, *Soils, Permafrost, *Aerial photography, Terrain, Site selection, Deposits, Floods, Seacoast, Rivers, Drainage, Colors, Plants, Botanay, Photointerpretation, Silt, Glaciers, Rock, Geology, Ice, Maps, Cold weather construction, Land forms, Remote areas, Flood plains, Tundra, Levees.

Water-deposited materials in Alaska are important for engineering uses because of their general flat topographic situation and abundance. For the purposes of this study, the airphoto patterns of water deposited materials are divided on the basis of origin as follows: coastal plain; stream-deposited materials in the form of flood plains and terraces; and deltas. There are several other water-deposited types such as lacustrine, valley fill, and the several outwash groups. Outwash materials are discussed in the chapter on glacial patterns since complete knowledge of the pattern and its suggested features frequently depend on an analysis of glacial events. Successful interpretation of conditions of various water-deposited materials is contingent on the treatment of each topographic situation as an entire and separate unit. (See also W71-01665)
W71-01666

PHENOMENON AND MECHANISM OF FROST HEAVING,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 08D.
W71-01726

SNOW AND ICE HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Watershed Management.
Walter U. Garstka.

n: The Progress of Hydrology, Vol 2 - Specialized ydrologic Subjects, Proceedings 1st International eminar for Hydrology Professors, Illinois Univer- ty, Urbana, July 13-25, 1969, p 717-728, ublished by Univ of Illinois, 1969. 12 p, 26 ref.

escriptors: *International Hydrological Decade, onferences, *Education, *Snow, *Ice, Research nd development, Snowpacks, Snowfall, Glaciers, reezing, Thawing, Water resources development, orecasting, Hydrology, Hydraulics, Snow manage- ent, Snow surveys, Projects, Research facilities, lodel studies, Instrumentation.
dentifiers: *Water resources research, Snow and e hydrology.

eaching of the hydrology of snow requires a true nterdisciplinary approach since it is based upon a ackground of meteorology, climatology, ther- odynamics, soil physics, forestry, hydrology, and athematics, including computer technology. The eaching of snow and ice hydrology may be per- ormed at various educational levels. At any level f education the subject must be presented in such way that it is integrated with the general field of ydrology and water resources development as one f the most important parts of man's responsibility or maintaining and improving the environment. (Knapp-USGS)
W71-01826

LACIERS AND SNOWPACKS: SOME COM- ON PROBLEMS IN NON-POLAR GLACIOLO- Y,
Geological Survey, Tacoma, Wash.
Mark F. Meier.
n: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International eminar for Hydrology Professors, Illinois Univer- ity, Urbana, July 13-25, 1969, p 729-736, ublished by Univ of Illinois, 1969. 8 p.

Descriptors: *International Hydrological Decade, Conferences, *Glaciers, *Snowpacks, *Water esources development, Research and develop- nent, Forecasting, Hydrology, Hydraulics, Educa- ion, Planning, Projects, Research facilities, Ex- loration, Laboratories, Model studies, Technolo- y, Computers, Instrumentation.
dentifiers: *Water resources research, *Glaciolo- y.

The general field of glacier hydrology is briefly in- roduced with special reference to the effect of glaciers on water supply in temperate and subpolar atitutdes. Problems and new approaches common o both the study of temperate latitutde glaciers nd to the economically more important problem of forecasting water supply from the seasonal snow cover are discussed. There is no basic difference between the objectives and kinds of research being done by snow hydrologists and by those who study glaciers. Some implications of these research needs to hydrologic education are also discussed. Glaciers are a water resource of major proportions. About three-fourths of all the fresh water in the world, equivalent to about 60 years of precipitation over the entire globe, is temporarily stored as glaci- er ice. Glaciers cover about 11% of the world's land surface. Although small by polar standards, glacier ice in more temperate regions is an important resource. In North America the volume of water stored as snow and ice in glaciers is far larger than that stored in all the lakes, ponds, rivers, and reser- voirs on the continent. (Knapp-USGS)
W71-01827

THE WATER STRUCTURE UNDER A GROW- ING SEA ICE SHEET,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
E. L. Lewis, and E. R. Walker.
Journal of Geophysical Research, Vol 75, No 33, p 6836-6845, November 20, 1970. 10 p, 9 fig, 13 ref.

Descriptors: *Water structure, *Ice-water inter- faces, *Oceans, Saline water, Sea ice, Water tem- perature, Latent heat, Density, Model studies, Profiles, Thermal properties, Thermocline, Ther- mometers.
Identifiers: *Cambridge Bay (Canadian Northwest), Thermistor.

Data illustrating seasonal changes in temperature and salinity profile beneath an annual sea ice cover at Cambridge Bay, Canadian Northwest Territo- ries, are presented. The water column heat loss is about 15% of the latent heat extracted for ice growth. Time series temperatures (measured over one month with a thermistor chain depending from the ice sheet) indicate penetrative convective plumes as a probable mechanism for profile changes and are tentatively related to laboratory studies. (Woodard-USGS)
W71-01909

2D. Evaporation and Transpiration

PART I, CONTROLLING THE SOIL MOISTURE ENVIRONMENT OF TRANSPIR- ING PLANTS, PART II, PREDICTION OF LEAF TEMPERATURE UNDER NATURAL AT- MOSPHERIC CONDITIONS,
Kentucky Water Resources Inst., Lexington.
For primary bibliographic entry see Field 02I.
W71-01660

MICROCLIMATE BEFORE AND AFTER IR- RIGATION,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 02I.
W71-01720

SIGNIFICANCE OF EVAPORATION IN HYDROLOGIC EDUCATION,
Illinois State Water Survey, Urbana.
W. J. Roberts.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois Univer- sity, Urbana, July 13-25, 1969, p 666-693, published by Univ of Illinois, 1969. 28 p, 8 fig, 26 ref.

Descriptors: *International Hydrological Decade, Conferences, *Evaporation, *Education, Research and development, Water supply, Mathematical models, Water balance, Hydrologic budget, Water resources development, Hydrology, Hydraulics, Mass transfer, Energy budget, Planning, Research facilities, Economics, Technology, Computers, In- strumentation.
Identifiers: *Water resources research.

Because evaporation is the second largest factor in the hydrologic cycle there is great need for accu- rate evaporation data for water resource planning. Surface water sources that rely upon streamflow should be designed to withstand dry weather condi- tions when evaporation is at a maximum and streamflow is at a minimum. In flat prairie, such as Illinois, the average depth of water supply reser- voirs is only 10 feet, and in most of these one-half of the reservoir capacity is stored in the top 3 feet of water. Normal annual evaporation is close to 3 feet; it is obvious that most reservoirs would fail in draughts if evaporation is not considered in the plans. Nearly 500 station-years of record have been collected from evaporation pans located throughtout the country. Evaporation calculations by water budget, energy budget, and mass transfer methods are described. Recent work on evapora- tion control is briefly reviewed. (Knapp-USGS)
W71-01824

EVAPOTRANSPIRATION A FACTOR IN THE PLANT-SOIL WATER ECONOMY,
Agricultural Research Service, Coshocton, Ohio. Soil and Water Conservation Research Div.
Lloyd L. Harrold.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois Univer- sity, Urbana, July 13-25, 1969, p 694-716, published by Univ of Illinois, 1969. 23 p, 2 fig, 22 ref.

Descriptors: *International Hydrological Decade, *Evapotranspiration, Education, Conferences, *Water resources development, Research and development, Forecasting, Hydrology, Land management, Water conservation, Water yield im- provement, Planning, Projects, Research facilities, Soil-water-plant relationships, Reviews, Laborato- ries, Model studies, Technology, Computers, In- strumentation.
Identifiers: *Water resources research.

Evapotranspiration is an important factor in the hydrologic cycle. It accounts for disposal of nearly 100 percent of the year's precipitation in arid lands and about 75 percent in humid regions. Wherever it goes through the food-fiber plant mechanism it is considered productive. In many places it is un- productive, except to recharge the atmospheric phase of the hydrologic cycle. Adjustments in land and water management can improve the efficiency of water use in food-fiber production. Mathemati- cal watershed performance models are being developed for predicting runoff from the function- ing of important parts of an entire flow system. ET prediction in this model greatly influences the results. Reference is made to a number of modern techniques for estimating potential evapotranspira- tion (PET) and for modifying these estimates to evaluate ET. The use of various types of lysimeters for measuring ET is discussed. (Knapp-USGS)
W71-01825

MICROMETEOROLOGICAL INVESTIGA- TIONS OF THE ENERGY BUDGET: EFFECT OF SUMMER WINDS,
Kansas Water Resources Research Inst., Manhat- tan.
E. L. Skidmore, H. S. Jacobs, L. J. Hagen, and W. L. Powers.
Available from NTIS as PB-195 927, $3.00 in paper copy, $0.95 in microfiche. Project Comple- tion Report, October 1970. 61 p, 2 tab, 20 fig, 4 ref. OWRR Project No. A-005-KAN (1).

Descriptors: *Evaporation, *Evapotranspiration, *Wind, Energy budget, Atmometers, Micrometeorology, Humidity, Shelterbelts.
Identifiers: *Barriers, *Windbreaks, *Shelter, *Potential evaporation, Microclimate, Air tem- perature, Bowen ratio, Solar radiation, Net radia- tion, Aerial environment, Slat-fence, Great Plains.

Summer wind enhances potential evapotranspira- tion in the Great Plains by a large but predictable amount. This high potential evaporation can be reduced by lowering windspeeds with windbreaks or barriers. Windbreaks reduce evaporation rates from a wet surface proportionably to windspeed reduction with a proportionality constant usually less than 0.5. Use of windbreaks for reducing wind- speed causes other changes in the microclimate. The highest humidity and humidity gradients, highest daytime air temperature, lowest nighttime air temperature, and generally the steepest tem- perature gradients all occurred in the ares where the windbreak reduced windspeed to the lowest level. The absolute humidity was lower at 12 times the windbrea's height leeward than in the open field. These findings indicate that windbreaks lower the evaporative demand and induce a more favora- ble environment for plant growth in the harsh cli- mate of the Great Plains. However, additional research is needed to evaluate plant response and actual evaporation as influenced by barrier induced microclimate. (McKenna-Kansas State)
W71-01889

CONSUMPTIVE USE OF WATER BY SUGAR- CANE IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.

Paul C. Ekern.
Available from NTIS as PB-195 978, $3.00 in paper copy, $0.95 in microfiche. Hawaii University Water Resources Research Center Technical Report No 37, July 1970. 93 p, 35 fig, 16 tab, 49 ref, 5 append. OWRR Project A-014-HI (1).

Descriptors: *Evapotranspiration, *Sugarcane, *Hawaii, Lysimeters, Irrigation, Percolation, Climatology, Soil moisture, Solar radiation, Evaporation pans, Rainfall, Chemical analysis, Water chlorides, Nitrates, Sulfates, Silica, Meteorological data, Hydrologic data.
Identifiers: Laboratory desorption curve.

Water use by sprinkler irrigated sugarcane under flat-bed culture was measured in four 100 sq ft by 5 ft deep hydraulically weighed lysimeters at the Kunia substation of the Hawaiian Sugar Planters' Association. Nine-week-old one-eye cane transplants were set into a 5-foot grid in Molokai Low Humic Latosol on October 27, 1968. Water use approached a 1:1 ratio with a conventional class A pan by late March 1969 for a 3.5 leaf area index. Average values were 0.25 in/day for the midsummer months. The cane was ratooned on May 10, 1969 and water use was reduced to a 0.33 fraction of pan evaporation. The cane regrew rapidly and water use was again equivalent to pan evaporation. The cane regrew rapidly and water use was again equivalent to pan evaporation by July 1969. Consumptive use by cane or pan often equalled or exceeded the net radiation, indicating strong positive advection of heat from the surroundings. During the early stages of cane growth, percolate from heavy winter rains contained as great as 225 ppm nitrate, but as the cane matured, the percolate had less than 1 ppm nitrate though the content of other solutes such as chloride, sulfate, and silica remained high. (Woodard-USGS)
W71-01902

2E. Streamflow and Runoff

AN ECONOMIC REAPPRAISAL OF THE TOLEDO BEND MULTIPLE-PURPOSE PROJECT,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 06B.
W71-01652

A MULTIVARIATE STATISTICAL MODEL FOR ESTIMATING THE NUMBERS, SIZES,AND INTERFLUVIAL DISTANCES OF STREAMS WITHIN A RELATIVELY HOMOGENEOUS DRAINAGE AREA.
Naval Postgraduate School, Monterey, Calif.

Available from NTIS as AD-706 058, $3.00 in paper copy, $0.95 in microfiche. MS Thesis, October 1969. 80 p, 10 tab, 12 fig, 36 ref.
Identifiers: *Terrain, Rivers, *Rivers, Mathematical prediction, Hydrology, Mathematical models, Multivariate analysis, Probability density functions, Theses, Geomorphology, *Streams, *Watersheds.

A model has been developed for estimating the number, sizes, and interfluvial distances of streams to be crossed in traversing a naturally occurring drainage basin. A relationship among four network parameters has been found which, upon quantification, provide sufficient information to completely structure a mature drainage system. The four parameters are: stream length ratio, basin shape parameter, and coefficient of drainage density. The model is amendable to computer solution. Procedures are described for parameter quantification using common topographic maps.
W71-01662

BOEHM V WERMUTH (DIVERSION OF STREAM FROM LANDOWNER'S PROPERTY).
For primary bibliographic entry see Field 06E.
W71-01677

ELLERSON FLORAL CO V CHESAPEAKE AND O RY (LIABILITY FOR FLOODING CAUSED BY EXTRAORDINARY RAINFALL).
For primary bibliographic entry see Field 06E.
W71-01770

FLOOD PLAIN INFORMATION, TUSCARAWAS RIVER, STARK COUNTY, OHIO.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W71-01773

FLOOD PLAIN INFORMATION, EAST FORK STONES RIVER, WOODBURY, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
W71-01774

EFFECTS OF AREAL AND TIME DISTRIBUTION OF RAINFALL ON RUNOFF HYDROGRAPHS,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
Tsong Chang Wei.
Ph. D. Thesis, Minnesota University, August 1970. 218 p, 31 fig, 28 tab, 71 ref, 2 append. OWRR Project A-017-MINN (1).

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Parametric hydrology, *Routing, Model studies, Runoff forecasting, Hydrographs, Hydrograph analysis, Prescipitation excess, Time lag, Synthetic hydrology.
Identifiers: Kinematic wave theory, Hydrograph synthesis.

A mathematical watershed model of 1.456 square miles was developed to route runoff through overland flow and through the channel system. Excess rainfall was used as input data and the flow was routed by the successive numerical solution of the kinematic wave equations to produce outflow hydrographs for elementary (first order) watersheds. These hydrographs were used as input to the channel system where the flow was routed by the successive numerical solution of the dynamic wave equations to yield the outflow hydrograph for the model watershed. The model was used to study the effects of time distribution and areal distribution of rainfall, storm movement and watershed shape on the runoff hydrograph. In general, the selected time, areal, storm movement and watershed shape factors have significant effects on peak discharge. These effects are listed and described. (Knapp-USGS)
W71-01775

SOME MORPHOMETRICAL RELATIONSHIPS IN THE MIDDLE AND LOWER REACHES OF THE AMU DARYA,
Sredneazuatsjuu Bauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 08B.
W71-01779

MORPHOLOGICAL PRINCIPLE OF MODELLING RIVER-BED PROCESS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 08B.
W71-01780

ON THE MEAN VELOCITY FORMULAS OF RIVERS,
Tokushima Univ. (Japan). Dept. of Civil Engineering.
Sutesaburo Sugio.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 257-260, 1969. 4 p, 3 fig.

Descriptors: *Sediment transport, *Regime, Channel morphology, Velocity, Streamflow, Sediment yield, Bed load, Dunes, Sand waves.
Identifiers: Streamflow velocity.

There are three typical groups of mean velocity formulas for alluvial streams described by Lacey's and Simons' concept that mean velocity is a function of the square hydraulic mean depth and river slope. The bed form for each group seems to correspond to ripples, dunes, and upper regimes, and a criterion chart is given for rough estimation of velocity. (Knapp-USGS)
W71-01784

COMPUTATION OF DOMINANT DISCHARGE,
Gifu Univ. (Japan). Dept. of Civil Engineering.
Saburo Komura.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 265-268, 1969. 4 p, 1 tab, 2 ref.

Descriptors: *Discharge (Water), *Streamflow, *Sediment transport, *Theoretical analysis, Mathematical studies, Equations, Computers, Sediment load, Bed load, Flow rates, Streambeds, Sediment distribution, Foreign projects.
Identifiers: *Dominant discharge (Water), *Japan.

Stream discharge and sediment transport parameters are used to formulate equations for computing dominant discharge. The dominant discharge can be computed from an equation by using mean daily water discharges and a relevant exponent value. The dominant discharge below the confluence is larger than the sum of the dominant discharges entering the confluence. (Woodard-USGS)
W71-01787

DIGITAL COMPUTER CALCULATION OF UNSTEADY OPEN-CHANNEL FLOW (FRENCH),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 08B.
W71-01800

ON THE SIMULATION OF RIVER-BED VARIATION BY CHARACTERISTICS,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 08B.
W71-01801

SIMULATION OF FLOOD PROPAGATION BY DIGITAL COMPUTER AND ITS APPLICATION TO RIVER PROBLEM,
Central Research Inst. of Electric Power Industry, Tokyo, (Japan).
For primary bibliographic entry see Field 08B.
W71-01802

LAMINAR FLOW IN OPEN RECTANGULAR CHANNELS (A CONTRIBUTION TO THE FLOW PROBLEM OF OPEN CHANNELS),
For primary bibliographic entry see Field 08B.
W71-01803

SIMILITUDE OF MOBILE BED MODELS AND THE EFFECTS OF VARIATIONS ON THE LAWS OF SIMILITUDE (FRENCH),
Robert College, Istanbul (Turkey). Dept. of Hydraulics.
For primary bibliographic entry see Field 08B.
W71-01804

DETERMINATION OF COEFFICIENTS OF HYDRAULIC LOSS FOR UNSTEADY OPEN CHANNEL FLOW (FRENCH),
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 08B.
W71-01805

SIMULATION OF THE BAVARIAN REACH OF THE DANUBE RIVER,
Technische Hochschule, Munich (West Germany).
For primary bibliographic entry see Field 08B.
W71-01806

ANALYTICAL SOLUTION OF WIENER-HOPF EQUATION FOR RUNOFF PREDICTION,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01807

A FRAMEWORK FOR EVALUATING CARBONATE HYDROLOGY,
Geological Survey, Raleigh, N.C.
Harry E. LeGrand.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 887-913, published by Univ of Illinois, 1969. 27 p, 29 ref.

Descriptors: *International Hydrological Decade, Conferences, *Hydrogeology, *Carbonate rocks, Reviews, Research and development, Karst, Groundwater movement, Water resources development, Forecasting, Hydrology, Hydraulics, Laboratories, Model studies, Technology.
Identifiers: *Water resources research.

The status of hydrology of carbonate-rock aquifer systems is reviewed. In many discussions of groundwater hydrology, carbonate terranes are often considered a qualified addendum or a special aspect. In contrast to almost all other types of rocks, limestones and other carbonates may have hydrologic conditions that appear to be self-engendered. For example, where other factors are not restrictive, circulation of water leads to solution of the rocks and, in turn, solution favors greater circulation. If specific studies and principles could be synthesized and could be brought together properly a better and quicker understanding of carbonate hydrology would be available. A few brief statements of some pertinent principles are presented to help get a useful perspective. (Knapp-USGS)
W71-01834

A SHORT HISTORY OF HYDROLOGY,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Resources Research Center.
For primary bibliographic entry see Field 02F.
W71-01835

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES - OPEN CHANNEL EXPANSIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 08B.
W71-01836

MEAN ANNUAL RUNOFF AS RELATED TO CHANNEL GEOMETRY OF SELECTED STREAMS IN CALIFORNIA,
Geological Survey, Washington, D.C.
E. R. Hedman.
Geological Survey Water-Supply Paper 1999-E, 1970. 17 p, 10 fig, 2 tab.

Descriptors: *Streamflow, *Average flow, Annual, *Channel morphology, *California, Perennial streams, Ephemeral streams, Runoff, Hydrologic data, Streams, Flow rates, Gaging stations, Discharge (Water).
Identifiers: Computations, Channel geometry.

The channel geometry of 48 gaged streams in California where mean annual runoff is known was studied in 1967 and 1968. The analyses show that the mean annual runoff is related to selected dimensions of channel geometry. The width and the average depth of the cross section between bars or berms can be used to estimate annual runoff from ungaged streams. Separate relations are needed for perennial and ephemeral streams. The analyses also showed that it is better to measure several cross sections, compute the discharge for each cross section, and average these discharges to obtain the discharge for the site. A 10-year period, 1958-67, was analyzed to determine if the channel dimensions were affected by recent hydrologic or climatic events. It was determined that the computed runoff represented a long-term mean' that is, the standard error of estimate was less for the regression using the runoff for the period of record rather than for the 10-year period. (Woodard-USGS)
W71-01906

A PROCEDURE FOR COMPUTING AND DISPLAYING TIME VARYING POWER SPECTRA ILLUSTRATED BY APPLICATION TO A GEOPHYSICAL PROCESS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 07C.
W71-01910

PRELIMINARY REPORT ON THE WATER RESOURCES OF NORTHEAST MAUI,
Geological Survey, Honolulu, Hawaii.
K. J. Takasaki, and George Yamanaga.
Hawaii Division of Water and Land Development Circular C60, Ausust 1970. 41 p, 10 fig, 6 tab, 8 ref.

Descriptors: *Water resources, *Hawaii, *Hydrologic cycle, Surface waters, Groundwater, Rainfall, Runoff, Streamflow, Flow rates, Aquifers, Permeability, Aquifer characteristics, Artesian wells, Discharge (Water), Water table.
Identifiers: *Noretheast Maui (Hawaii), Well logs.

Northeast Maui, as described in this report, includes about 165 square miles of the northeast and east slopes of Haleakala. Large forest reserves, on lands too wet for cultivation or at altitudes too high for development, make up much of the area. The lower, drier slopes are used mainly for grazing, and smaller areas for orchards and taro cultivation. Population in 1969 was less than 1,500. The hydrology and geology, as outlined, is based on published and unpublished reports of findings of previous investigators, and on records of stream and ditch flows published by the U. S. Geological Survey. It describes in general, the occurrence of water and some of the geologic features that control its movement and availability. It also summarizes and updates information available on groundwater and on stream and ditch flows. Tables of data include chemical quality analyses, stream discharge rates, and well records. (Woodard-USGS)
W71-01911

WATER RESOURCES INVENTORY OF CONNECTICUT - PART 4. SOUTHWESTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
Robert B. Ryder, Michael A. Cervione, Jr., Chester E. Thomas, Jr., and Mendall P. Thomas.
Connecticut Water Resources Bulletin No 17, 1970. 54 p, 33 fig, 3 plate, 19 tab, 57 ref.

Descriptors: *Water resources, *Connecticut, *Surface waters, *Groundwater, Precipitation (Atmospheric), Runoff, Streamflow, Reservoirs, Estuaries, Hydrologic data, Water quality, Temperature, Water supply.
Identifiers: Southwestern coastal river basins (Conn).

Information and data concerning water resources of 440 square miles of the southwestern coastal river basins (394 square miles of which are in Connecticut) are presented. Maps, graphs, figures, and tables of data relate precipitation, streamflow, reservoirs, estuaries, groundwater, temperature and water quality. Much of the water in the basins is of good to excellent chemical quality and contains a low concentration of dissolved solids. However, the quality of water in many streams, flowing through urban areas is impaired by man's activity. Also, the quality of groundwater in localized areas is affected by domestic and industrial wastes, road-salting chemicals, and by salt water from estuaries and Long Island Sound. The total amount of water used in the basins in 1965 was about 36.7 billion gallons or about 165 gpd per capita; 87% of the total was supplied by water utilities. The water-utility systems are supplied by many reservoirs, several in the same drainage basin. (Woodard-USGS)
W71-01912

STREAM DISPERSION AT SELECTED SITES,
Geological Survey, Washington, D.C.
Richard G. Godfrey, and Bernard J. Frederick.
For sale by Superintendent of Documents, U S Government Printing Office, Washington, D. C. 20402 - Price $0.55. Geological Survey Professional Paper 433-K, 1970. 38 p, 6 fig, 15 tab, 11 ref.

Descriptors: *Dispersion, *Tracers, *Streams, Testing, California, Tennessee, Virginia, Streamflow, Channels, Canals, Flow rates, Diffusion, Time, Turbulence, Analysis, Theoretical analysis, Model studies.
Identifiers: *Radiotracer (Gold-198).

Tests were conducted by the U. S. Geological Survey, in cooperation with the U. S. Atomic Energy Commission in California, Tennessee, and Virginia to study the dispersion patterns of a radiotracer in five natural stream channels and in one canal. The radiotracer, gold-198, was injected as a line source. The patterns of dispersion that were observed in these channels were compared with patterns predicted by the theoretical model for one-dimensional flow developed by G. I. Taylor (1954). Analysis of the relation between time and concentration of the tracer at several sections in each of the six reaches shows that his theoretical model is not adequate to describe the dispersion patterns actually observed. Dispersion coefficients determined from the test data, though constant as theoretically predicted, are about 4 to 35 times greater than those predicted by Taylor. (Woodard-USGS)
W71-01914

AN EVALUATION OF STREAMFLOW TIMING FROM SMALL WATERSHED IN NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. School of Forest Resources; and Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
William E. Soper, and Howard W. Lull.
Proceedings Paper from 14th International Union Forestry Research Organizations Conference, Munich, Germany, September 1967, p 281-297, 1967. 17 p, 1 fig, 5 tab, 11 ref. OWRR Project No A-006-PA (7).

Descriptors: *Rainfall-runoff relationships, *Watershed management, Depth-area-duration analysis, *Base flow, *Peak discharge, Flow rates, Timing, Discharge (Water), Streamflow, Gaging stations, Topography, Slopes, Precipitation (Atmospheric), Climatic zones, Vegetation effects, Runoff coefficient, Mathematical studies.
Identifiers: *New England and bordering States.

Daily streamflow records for a 17-year period from 134 small watersheds, less than 100 square miles in area, were utilized to evaluate streamflow timing in northeastern United States. Criteria used to characterize streamflow timing were high-flow and low-flow intervals. Maps, tables of data, and interpretations of results of the study are included. In summary, latitude, mean maximum January temperature, elevation, relief, and forest cover percentage are the variables most highly correlated with high-flow intervals and beginning dates. A greater number of days were required to produce 1 and 5 percent of annual flow in the northern re-

gions than in the southern. Latitude, mean maximum July temperature, elevation, and forest cover percentage were variables most highly correlated with low-flow intervals. (Woodard-USGS)
W71-01917

CALIBRATION ANALYSIS OF THE THREE LEADING RIDGE EXPERIMENTAL WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
Thomas H. Yorke, Jr.
M. S. Thesis, Pennsylvania State University Institute for Research on Land and Water Resources, September 1967. 76 p, 13 fig, 20 tab, 30 ref, append. OWRR Project No A-006-PA (10).

Descriptors: *Watershed management, *Rainfall-runoff relationships, *Erosion control, *Water yield, *Forestry, Forest management, Sedimentation, Base flow, Depth-area-duration analysis, Depth-area curves, Floods, Infiltration, Overland flow, Pennsylvania, Topography, Vegetation effects.
Identifiers: *Calibration analysis, *Experimental watersheds.

To determine relationships between water regimens of 6 experimental watersheds in the Stone Valley Experimental Forest, Pennsylvania, to serve as a datum for estimating runoff after various forest treatments have been applied, 6 years of rainfall and runoff records were collected and analyzed. Calibrations were made of 3 watersheds in the Leading Ridge Unit to determine the water-yield regimens. Highest correlations exist between the annual flow of Watersheds One and Three and Watershed Two and Three where the coefficients were 0.999 and 0.997. Watershed Two is the best control for low flow conditions. Increases of 1.5 area-inches on Watershed One and 1.7 area-inches on Watershed Three during the first growing season after treatment will be significant. Increases of 2.1 and 1.4 area-inches respectively on Watersheds One and Two during the first dormat season will be statistically significant. In conclusion, Watershed Two is the most suitable to leave in natural state as the control for watershed treatment experiments. (Lang-USGS)
W71-01918

ON THE SHORELINE AND LEADING FRONT CONDITIONS OF TSUNAMI WAVES IN THE LIGHT OF THE METHOD OF CHARACTERISTICS,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
Toshio Iwasaki, and Hiroyoshi Togashi.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 501-508, 1969. 8 p, 5 fig, 12 ref.

Descriptors: *Tsunamis, *Shores, *Tidal effects, *Bores, Theoretical analysis, Coasts, Sea walls, Beaches, Equations.

A tsunami wave approaching a sloping beach has a bore front even if the surface slope is horizontal. The bore height decreases as it approaches the shoreline and ultimately disappears to become simply a positive disturbance. Shoreline conditions and overflow at the composite type beach where a vertical quaywall is located on a sloping beach is treated for a nonbreaking tsunami. Shoreline and front conditions are investigated theoretically. (Woodard-USGS)
W71-01940

MODELING FEEDLOT RUNOFF POLLUTION,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering; and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W71-02040

DESIGN OF A HYDROLOGIC CONDITION SURVEY USING FACTOR ANALYSIS.
For primary bibliographic entry see Field 04D.
W71-02085

BENNETT V CUPINA (LIABILITY OF LANDOWNER FOR ALTERING GRADE OF LAND).
For primary bibliographic entry see Field 06E.
W71-02086

SOZANSKA V TOWN OF STRATFORD (DRAINAGE OF SURFACE WATER DISCHARGED FROM PUBLIC STREETS).
For primary bibliographic entry see Field 06E.
W71-02094

DUGAN V LONG (LIABILITY FOR DIVERSION OF NATURAL FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02126

MILLER V PERKINS (OBSTRUCTION OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02186

2F. Groundwater

THE INFLUENCE OF GROUNDWATER SALINITY ON PLANT GROWTH,
Arizona Univ., Tucson. Environmental Research Lab.
James W. O'Leary.
American Association for the Advancement of Science, Committee on Desert and Arid Lands Zones Research, Groundwater Salinity Symposium, Las Vegas, New Mexico, April 23, 1970, paper presented. 13 p, 2 fig.

Descriptors: *Evapotranspiration, *Permeability, *Plant growth substances, *Saline water, *Groundwater, Salt tolerance, Arid lands, Irrigation practices, Plant physiology, Saline soils, Stomata, Turgidity, Leaves, Soil-water-plant relationships, Water balance, Irrigation canals, Humidity, Metabolism, Moisture deficit, Photosynthesis, Water utilization, Root systems, Moisture stress.
Identifiers: *Cytokinins, *Senescence, *Succulence.

Water flow in plant tissue is a direct function of tissue permeability and water potential. As groundwater salinity increases, plant growth invariably decreases. Current thinking assigns this result to decreases in root permeability. Under high evaporative conditions (low humidity), water stress occurs and tissue turgor decreases, resulting in partial stomatal closure which tends toward restoration of water balance equilibrium. Under low evaporative demand, water balance is maintained, but leaf succulence increases in the absence of leaf expansion - due to decreased cell wall extensibility which resembles cell senescence. Plants subjected to increasing salinity undergo decreasing root cytokinin synthesis which disrupts Krebs cycle activity and results in premature onset of senescence. This metabolic upset also decreases root cell permeability and water uptake. This is confirmed by decreased photosynthetic rates in stressed plants, which is reversed by cytokinin application to the leaves. In arid lands irrigation, salts are bound to accumulate in groundwater unless they are washed away. This process is most practical in coastal areas and least practical in inland areas. A note of caution is therefore sounded with respect to the Central Arizona Project which is an inland irrigation scheme. (Casey-Arizona)
W71-01701

GROUNDWATER IN THE POTOMAC RIVER BASIN,
Geological Survey, Arlington, Va.
F. W. Trainer, D. J. Cederstrom, and F. A. Watkins.
The Potomac Newsletter, Vol 14, No 6, p 1-6, June 24, 1970. 6 p, 11 ref.

Descriptors: *Groundwater, *Water supply, *Aquifers, *Water quality, Water pollution, Geology, Hydrology, Topography, Water wells.
Identifiers: *Potomac River Basin.

The Potomac River basin, in West Virginia, Pennsylvania, Maryland, Virginia, and the District of Columbia, extends across the middle Atlantic region from the Allegheny Plateau to Chesapeake Bay. It is characterized by wide diversity of terrain -- the sum of topography, rocks, and soils which forms the environmental framework of a region -- but in the broad view we can distinguish two water provinces: an upstream province of hard rocks, in the Appalachian Mountains, Blue Ridge, and Piedmont; and a downstream province, the Coastal Plain or Tidewater region, underlain by beds of relatively soft sand and clay. Despite broad similarity in climate thoughout the basin, the regional movement of water differs considerably in these two provinces, and water use and water problems also differ. Groundwater characteristics in the basin are reviewed under the following topics: The Water Supply; The Water System in the Upper Basin; The Water System in the Coastal Plain; The Availability of Groundwater; and Quality of the Groundwater. (Woodard-USGS)
W71-01815

HYDROGEOLOGIC DATA FOR THE LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
Michael A. Cervione, Jr., I. G. Grossman, and Chester E. Thomas, Jr.
Connecticut Water Resources Bulletin No 16, 1968. 65 p, 1 fig, 1 plate, 10 tab, 15 ref.

Descriptors: *Hydrologic data, *Water wells, *Streamflow, *Water quality, Data collections, Connecticut, Groundwater, River basins, Lakes, Reservoirs, Precipitation (Atmospheric), Sediment discharge.
Identifiers: Thames River (Conn), Hydrogeologic data.

This report presents data collected from 1963 to 1965 for an area of 440 sq mi in southeastern Connecticut and about 5 sq mi in Rhode Island. Records of 740 wells and 5 springs are given in tables showing location, owner or name, altitude, water-yielding material, and utilization, among other information. Logs of material penetrated in 229 wells and test holes are tabulated. Partial records of streamflow collected at 33 gaging stations are given, and one to three discharge measurements made at each of 25 miscellaneous sites during 1963 and 1964 are listed. Chemical analyses are tabulated for water from 195 wells and springs and for 283 samples from streams, lakes, and reservoirs. Analyses of suspended sediment and turbidity at 8 miscellaneous gaging sites, and chemical analyses of 38 precipitation samples from four sites are tabulated. Water resources data are plotted on a detailed topographic map with 10-foot contour intervals, scale 1:48000. (Lang-USGS)
W71-01816

SUBSURFACE WATER - GROUNDWATER,
Nevada Univ., Reno. Center for Water Resources Research.
George B. Maxey.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 787-815, published by Univ of Illinois, 1969. 29 p, 9 fig, 33 ref.

Descriptors: *International Hydrological Decade, Conferences, *Hydrogeology, *Reviews, *Groundwater movement, Research and development, Flow nets, Water chemistry, Water resources development, Forecasting, Hydrology, Hydraulics, Tracers, Tracking techniques, Systems analysis, Planning,

rojects, Research facilities, Exploration, conomics, Laboratories, Model studies, echnology, Computers, Instrumentation.
lentifiers: *Water resources research.

he literature of hydrogeology is reviewed with nphasis on work published since 1960. The de- ands of water-resource planning, development, nd management in our time require attention by rth scientists to the whole water cycle and there- re to the interrelationships between the rocks and rface, soil, and groundwater. One of the major lvances in hydrogeology in the past decade has en the recognition of the need to utilize more ydrodynamic principles in analysis of the natural tuation. Specifically, recent developments emming largely from the work of Hubbert (1940) nd the application of flow net techniques have sulted in more realistic and highly applicable ap- oaches to the solution of groundwater flow stem problems. Theoretically, certain aspects of e hydrologic system could be reflected by the emistry of the water involved. Similarly, radioac- ve tracers, such as radiocarbon and tritium, which low, through age determinations, a knowledge of e velocity of movement of water may also be very elpful in system studies. Geologic data must be oduced that can be reduced or developed into athematical models which are subject to com- uter analysis. (Knapp-USGS)
71-01831

ROUNDWATER HYDROLOGY - RECENT EVELOPMENTS,
rinceton Univ., N.J., School of Engineering and pplied Science.
oger J. M. De Wiest.
: The Progress of Hydrology, Vol 2 - Specialized ydrologic Subjects, Proceedings 1st International eminar for Hydrology Professors, Illinois Univer- ty, Urbana, July 13-25, 1969, p 816-820, ublished by Univ of Illinois, 1969. 5 p, 1 ref.

escriptors: *International Hydrological Decade, onferences, *Groundwater movement, Hydrogeology, Reviews, Research and develop- ent, Mathematical models, Darcy's law, Porous edia, Water resources development, Forecasting, ydrology, Hydraulics, Aquifers, Computer odels, Laboratories, Model studies, Technology, omputers, Instrumentation.
lentifiers: *Water resources research.

summary account based on knowledge of An- losaxon literature on groundwater hydrology is iven of the progress that has been made since C. . Theis founded modern well hydraulics in 1935. he simplest case of isothermal groundwater flow mathematically described by the combination of n equation of conservation of mass and of a arcy-type equation relating macroscopic velocity, ead loss along the seepage path, and hydraulic onductivity of the medium. The resulting dif- erential equation leads to the formulation of classi- al boundary and initial value problems. Most of ne solutions available in the literature are con- erned with only one aquifer. When more than one quifer is present a system of simultaneous dif- erential equations with suitable boundary condi- ons has to be solved and the results become very omplicated. Therefore, practical problems can nly be solved by means of analogs and computers. Among the analogs, the electric R - C model and ne viscous flow model (Hele-Shaw apparatus) ave been much refined in recent years and their se is now widespread. Unsteady unsaturated flow as been studied extensively by agronomists who lso spent much time and effort in finding solutions o free surface flow problems. It has been possible o arrive at a Darcian-type description of two-phase luid systems in heterogeneous porous media and to nd solutions of some simplified problems by neans of computers. In general, most of the esearch has been academic in nature and has elped very little in solving the day to day problems acing the practicing hydrologist. (Knapp-USGS)
71-01832

A SHORT HISTORY OF HYDROLOGY,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Resources Research Center.
Asit K. Biswas.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 914-936, published by Univ of Illinois, 1969. 23 p, 1 fig, 1 tab, 22 ref.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Hydrogeology, *History, Research and development, Groundwater movement, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Technology.
Identifiers: *Water resources research.

The development of the science of hydrology is very briefly traced from about 3500 B.C. to the end of the nineteenth century. At present, very few hydrologists have a good knowledge of their heritage or have a broad understanding of how the science has developed even to its present imperfect state. Often undergraduate and graduate hydrology students have the impression that it is a new subject, which probably began in the twentieth century. It is strongly recommended that at least one hour be devoted, at the beginning of any course on hydrology, to the study of its special history. The time devoted for such a study would certainly be very well spend. (Knapp-USGS)
W71-01835

HYDROLOGIC DATA REDUCTION TECHNIQUES AND UNIT CONVERSIONS FOR USE IN THE OGRE, T-WAVE, FLIP, AND RAVE FLUID FLOW CODES,
California Univ., Livermore. Lawrence Radiation Lab.
John A. Korver.
Available from NTIS as UCRL-50854, $3.00 in paper copy, $0.95 in microfiche. March 13, 1970. 7 p, 2 tab, 1 fig, 6 ref.
Identifiers: *Groundwater, Gravity anomalies, *Gravity anomalies, *Programming (Computers), *Nuclear explosions, Hydrology, Computer programs, Coding, Mathematical models, Open channel flow, Incompressible flow, Flow charts, Input output routines, Radioactive wastes, T WAVE computer code, FORTRAN 2 programming language, FORTRAN, Finite difference theory.

Methods used to determine kH, the permeability-thickness product for a given location, from hydrologic test data are described, and methods for converting the units of permeability to the correct dimensional form for use in specific computer codes for analyzing ground water flow are presented. (See also W71-01886)
W71-01887

PRELIMINARY REPORT ON THE WATER RESOURCES OF NORTHEAST MAUI,
Geological Survey, Honolulu, Hawaii.
For primary bibliographic entry see Field 02E.
W71-01911

WATER RESOURCES INVENTORY OF CONNECTICUT - PART 4. SOUTHWESTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-01912

REMOVAL OF SALINE WATER FROM AQUIFERS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 05G.
W71-01932

QUANTITY OF WATER FLOWING INTO CIRCULAR INFILTRATION GALLERY,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
For primary bibliographic entry see Field 02G.
W71-01933

STATISTICAL DETERMINATION OF PERMEABILITY BY THE PORE SIZE DISTRIBUTION IN POROUS MEDIA,
Osaka Univ. (Japan). Dept. of Civil Engineering; and Osaka Prefectural Technical Coll., Neyagawa (Japan).
For primary bibliographic entry see Field 02G.
W71-01934

GENERAL CHARACTERIZATION OF DIFFERENT TYPES OF SEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01935

STUDY OF GROUNDWATER MOUNDS UNDER SPREADING AREAS,
Indian Inst. of Tech. (Bombay).
For primary bibliographic entry see Field 04B.
W71-01936

THE SIMULATION OF THE MOVEMENT OF AN INTERFACE BETWEEM SALT AND FRESH WATERS IN A COASTAL AQUIFER BY THE AID OF AN RC ANALOG,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W71-01941

A STUDY ON THE SEEPAGE FLOW OUT OF A FRESH WATER CANAL IN THE GROUND SATURATED WITH SEA WATER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-01943

RELATIONSHIP BETWEEN VELOCITY OF SEEPAGE AND HYDRAULIC GRADIENT IN THE ZONE OF HIGH VELOCITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 08B.
W71-01947

THE LINEAR AND NON-LINEAR REGIMES OF THE FILTRATION LAW AND THEIR CONSEQUENCES IN GEOHYDRAULIC PROBLEMS,
Hydraulic Research Inst., Prague (Czechoslovakia).
F. Slepicka.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 57-65, 1969. 9 p, 2 fig.

Descriptors: *Groundwater movement, *Darcys law, Turbulent flow, Artesian wells, Flow, Porous media, Velocity, Turbulence, Froude number, Hydraulic conductivity, Hydraulic gradient.
Identifiers: Non-linear groundwater flow, Non-Darcian flow.

Expressions derived on the basis of theoretical analysis and verified experimentally show that: (a) the domain of validity of the linear filtration law has its lower and upper limits; (b) the conventional equations for free or artesian drawing wells may be precisely stated only in the case when the linear regime governs in the whole region influenced by the well; and (c) for conditions outside the limits of validity of the linear law, valid expressions may be derived for the non-linear regime. (Knapp-USGS)

W71-01948

SEEPAGE LAW FOR MICROSEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01950

FLOW OF IMMISCIBLE FLUIDS IN UNCONFINED AQUIFERS,
Themistocles Dracos, and H. Oliver Schiegg.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4, (Subject D), Science Council of Japan, Kyoto, p 17-23, 1969. 7 p, 5 fig, 5 ref.

Descriptors: *Groundwater movement, *Path of pollutants, *Oily water, *Hydraulic models, Model studies, Seepage, Aquifers, Soil water movement, Viscosity, Permeability, Darcy's law, Capillary conductivity.
Identifiers: *Oil spills, Immiscible flow, Multiphase flow.

The increase in the use of mineral oil products in the thickly populated areas of central Europe has led to a certain danger of pollution of important groundwater resources. Accidental infiltration of oil products during transport, transfer, and storage cannot be avoided. For the design of appropriate protective measures against oil pollution and for efficient sanitation after oil accidents it is necessary to understand the flow of liquid oil products in unconfined aquifers. The flow of oil products in unconfined aquifers and the problems arising from them were studied in laboratory models. The experiments were made in a tilting flume 4.0 m long and 0.20 m wide. The aquifer was simulated by a homogeneous quartz sand filling 0.60 m high through which a steady uniform flow of water was maintained with two overflows at the inlet and outlet of the flume. Following a phase of vertical infiltration, a horizontal spreading of the oil occurred inside the capillary fringe and above the phreatic line. In a homogeneous aquifer the oil spreads above the phreatic line and inside the capillary fringe. The oil spread is substantially slower than the groundwater flow and strongly decelerated when the oil feeding ceases. Determination of the water saturation distribution above the phreatic line shows that the oil spreads in the lower range of the zone, in which both the water and the air are in the funicular stage and hence both mobile. (Knapp-USGS)
W71-01951

2G. Water in Soils

THE INFLUENCE OF GROUNDWATER SALINITY ON PLANT GROWTH,
Arizona Univ., Tucson. Environmental Research Lab.
For primary bibliographic entry see Field 02F.
W71-01701

DIAGNOSIS OF SODIC CONDITIONS IN SALINE-ALKALI SOILS OF WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India).
A. S. Kolarkar, and N. Singh.
Annals of Arid Zone, Vol 9, No 1, p 31-35, March 1970. 3 fig, 8 ref.

Descriptors: *Laboratory tests, *Sodium, *Alkaline soils, *Saline soils, *Arid lands, Clays, Clay loam, Regression analysis, Soil profiles, Adsorption, Hydrogen ion concentration, Correlation analysis, Analytical techniques.
Identifiers: *West Rajasthan, *India, *Sodic conditions, *Sodium adsorption ratio (SAR), *Exchangeable sodium percentage.

Estimation of soil exchangeable sodium percentage (ESP) is expensive and time-consuming. Soil pH determinations are simple and quick and sodium adsorption ratios (SAR) are also easier to determine than ESP. Attempts were therefore made to find relationships between ESP and pH and ESP and SAR to facilitate easier ESP determination. Thirty-two saline-alkali soils from arid West Rajasthan were analyzed for all 3 characteristics. Simple linear regression lines were obtained for ESP vs. both SAR and pH. Because of the simpler techniques involved, it was felt that the pH-ESP relationship would be most useful. An equation developed by the U.S. Salinity Laboratory for ESP as a function for SAR was shown inadequate for these purposes. (Casey-Arizona)
W71-01706

EOLIAN SEDIMENT INFLUENCE ON PEDOGENESIS DURING THE QUATERNARY,
Wisconsin Univ., Madison. Department of Soil Science; Chicago Univ., Ill.; and California Univ., Riverside. Dept. of Geological Sciences.
J. K. Syers, M. L. Jackson, V. E. Berkheiser, R. N. Clayton, and R. W. Rex.
Soil Science, Vol 107, No 6, June 1969, p 421-427. 4 tab, 2 fig, 25 ref. AEC AT (11-1)-1515, NSF Grant GA-1108 and GA-1390.

Descriptors: *Aeolian soils, *Sierozems, *Soil gases, *Soil chemistry, *Quaternary period, Hydrologic properties, Soil physics, Aerosols, Arid lands, Loess, Quartz, Particle size, Winds, Sediments, Dusts, Deposition (Sediments), Oxygen, Fine-textured soils.
Identifiers: *Eolian sediment, *Pedogenesis, *Oxygen isotopic composition, *Aerosolic dust, *Wind-blown sediment, Trade winds, African dusts, Hawaiian soils, North-central U.S., East-central Pacific.

Loess and aerosolic dust can be detected in soils through determination of the oxygen isotopic composition of quartz as a particle-size function. These eolian deposits have developed extensive desert soils, and affect hydrologic properties of such soils. The delta-18-0 for fine silt varies from 16 for African dusts circulating in the Caribbean Trade Winds, to 18 for pelagic sediments of east-central Pacific, correlative Hawaiian soils, and arid land sources on the Asian continent, to 24 plus or minus 3 in calcareous loess of north-central USA. Delta values decrease with particle coarseness because of increasing granite-derived quartz contribution. Loess distribution is intracontinental. Aerosolic dust distribution is intercontinental. The aerosolic dusts are transported by world-wide winds, jet streams, rainfall and nuclear explosion. Tables show classification of selected minerals, soils, loess and aerosolic dust. The variation in oxygen isotopic weight with particle size of quartz, and location of study areas with respect to prevailing winds are shown. (Popkin-Arizona)
W71-01709

THE VEGETATION OF SUPERFICIAL IRONSTONE HARDPANS IN SIERRA LEONE,
Bristol Univ. (England). Dept. of Botany.
D. Gledhill.
Journal of Ecology, Vol 58, No 1, p 265-274, March 1970. 1 fig, 1 tab, 3 ref.

Descriptors: *Laterites, *Hardpan, *Vegetation, *Impervious soils, *Algae, Weathering, Microenvironment, Droughts, Drainage, Exposure, Erosion, Geomorphology, Soil water, Soil-water-plant relationships, Soil types, Soil density, Subsoil, Iron compounds, Soil groups, Tropical regions, Geologic formations, Wet seasons, Dry seasons, Topography, Climax, Plant populations.
Identifiers: *West Africa, *Sierra Leone, *Insular flora, *Algal mats, *Ironstone, Climax vegetation, Geologic age, Plant communities.

Laterites are red-brown earths rich in Fe, Cr, Al and Mn, occurring under forest and desert conditions alike. Their depths at given sites are dependent upon topography, seasonal changes in soil saturation by groundwater and the relationship between rates of laterization and erosion. Superficial ironstone hardpans occur in poorly drained sites owing to the uncovering of soil by surfacr erosion. Wherever found they are shallowly flooded by fresh water once a year. The habitats of 3 groups of hardpans in Sierra Leone, West Africa, are described together with their associated plant communities. Algal mats form in depressions and eroded areas and obstruct water flow across the surfaces. The algal species and all other plant species present are listed. The hardpan habitat is highly resistant to change, resulting in a specialized insular flora regarded as a climax under refuge conditions. Since the age of the flora depends on the age of the hardpan and slow successional and evolutionary changes, the possibility of determining the age of a hardpan from its flora is discussed. It is felt that the problem will have to be approached from a geological rather than a biological basis. (Casey-Arizona)
W71-01710

THERMODYNAMIC EQUILIBRIUM CONSTANTS OF SODIUM-CALCIUM EXCHANGE IN SOME ISRAEL SOILS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ., Jerusalem (Israel).
Rachel Levy, and D. Hillel.
National and University Institute of Agriculture, Rehovoth, Israel, 1967 Series, No 1186-E. Soil Science, Vol 106, No 5, November 1968, p 393-398. 3 tab, 2 fig, 8 equations, 13 ref.

Descriptors: *Thermodynamics, *Equilibrium, *Soil chemistry, *Calcium, *Sodium, Sierozems, Arid lands, Equations, Soil types, Clays, Loam, Ion exchange.
Identifiers: *Thermodynamic equilibrium constants, *Sodium-calcium exchange, *Soil-water relations, *Activity coefficient, *Israel, Exchangeable calcium, Electrostatic forces.

Sodium-calcium exchange thermodynamic equilibrium constants of three soil types of Israel were calculated by using the sodium monoform as a reference state and by ascribing an activity coefficient of 0.5 to the exchangeable calcium when at a mole fraction of unity. Thermodynamic equilibrium constant comparisons revealed that two of the soils (residual clay loam, sandy clay loam hamra) show a preference for calcium twice larger than the grumusolic silty clay. Interaction forces between the exchangeable ions and the soil matric were long-range electrostatic ones, but the role of other forces were important at low mole fractions of exchangeable sodium. Tables of solution composition, calculated values of selectivity coefficients, and calculated thermodynamic equilibrium constants are shown. Figures of exchange isotherms, and selectivity as a function of exchangeable mole fraction are included. (Popkin-Arizona)
W71-01717

ARTIFICIAL GROUNDWATER RECHARGE THROUGH BASINS IN THE TEXAS HIGH PLAINS,
Agriculture Research Service, Bushland, Tex.
For primary bibliographic entry see Field 04B.
W71-01719

STABILIZATION OF SHEAR-GENERATED SOIL AGGREGATES,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
Lalit Mohan Arya.
M.S.Thesis, Minnesota University, December 1969. 63 p, 8 fig, 5 tab, 48 ref, append. OWRR Project No B-015-MINN (1).

Descriptors: *Soil structure, *Soil aggregates, Soil stability, Soil moisture, Soil physical properties, Soil mechanics, Soil strength, Shear strength, Soil texture, Soil management, Cultivation, Puddling, Soil treatment.
Identifiers: Soil-aggregate bonding.

xperiments were conducted to test the hypothesis at freshly formed aggregates in field soils stabilize ver a period of time after formation. These aggegates included (1) natural aggregates from field ils collected immediately after plow-shearing, (2) mulated earthworn casts, and (3) aggregates oduced by coalescence of dry soil particles ound a droplet. In all cases, aggregates were aged constant water content and wet-sieved at different times to investigate whether the stability ineased with time. Natural aggregates from field ils showed an increasing stability with time. mulated worm-casts increased in stability with ing as did shear-generated aggregates. Both inil and final stabilities of water-drop aggregates ere lower than for plow-shear generated aggegates or simulated earthworm casts. There are portant practical implications of these results. fter plowing, secondary tillage should not be cared out until aggregates can withstand further ear forces. The waiting period should be at least) to 12 hours. Rain soon after plowing will do a eater damage to soil structure than at a later time hen intra-aggregate bonds have strengthened. (Kpp-USGS)
71-01771

UBSURFACE WATER - GROUNDWATER,
evada Univ., Reno. Center for Water Resources esearch.
or primary bibliographic entry see Field 02F.
71-01831

HE MOVEMENT OF WATER IN UNSATUATED SOILS,
inois Univ., Urbana. Dept. of Soil Physics.
. Klute.
: The Progress of Hydrology, Vol 2 -Specialized ydrologic Subjects, Proceedings 1st International eminar for Hydrology Professors, Illinois Univerty, Urbana, July 13-25, 1969, p 821-888, ublished by Univ of Illinois, 1969. 68 p, 21 fig, 1 b, 103 ref.

escriptors: *International Hydrological Decade, onferences, *Soil-water movement, *Reviews, ibliographies, Hydrogeology, Unsaturated flow, aturated flow, Water chemistry, Research and evelopment, Water resources development, orecasting, Hydrology, Hydraulics, Soil chemisy, Porous media, Evapotranspiration, Soil-waterlant relationships, Model studies.
dentifiers: *Water resources research, Soil waterroundwater relationships.

he part of the hydrologic cycle which deals with ie transport of water in the soil profile down to nd including the water table is reviewed. The rocesses of infiltration, redistribution, percolaon, drainage and evaporation occur in this region. soil profile is characteristically nonuniform in its roperties, nonisothermal, and may be nonrigid. licroorganisms and the roots of higher plants are a ery intimate part of the system. The region is haracterized by cyclic fluctuation of water conent as water is removed from the soil profile by vapotranspiration and replenished by rainfall or rigation. The movement and retention of water in nsaturated porous media may be approached rom (a) the molecular, (b) the microscopic or (c) ie macroscopic viewpoint. It is quite evident that echarge of the groundwater and discharge from it ust traverse the unsaturated zone by way of the rocesses of infiltration, percolation and evaporaon. Soil physicists have not given much attention groundwater flow, and conversely groundwater ydrologists have tended to avoid consideration of ie unsaturated flow region. The groundwater flow egion and the unsaturated region above it are part f a continuous and interacting system. The flow of vater in the entire system can be physically and nathematically described without the imposition of rtificial boundaries. It is probable that there are implifying assumptions that can be made that vould incorporate the essential features of unsatuated flow theory into the treatment of a groundvater problem. Exactly what these may be will ave to be determined after study of the problem ased on unified flow models. (Knapp-USGS)

W71-01833

QUANTITY OF WATER FLOWING INTO CIRCULAR INFILTRATION GALLERY,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
Toshihiko Ueda, and Satoru Sugio.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 175-182, 1969. 8 p, 9 fig, 4 ref.

Descriptors: *Groundwater movement, *Water wells, Mathematical models, Analog models, Hydraulic models, Aquifers, Water levels, Mathematical studies, Tunnels, Conjunctive use, Surface-groundwater relationships.
Identifiers: *Infiltration galleries, Horizontal wells.

Flow of water into a circular infiltration gallery was studied under the condition that uniform and water-saturated soil is covered by ponded water. The equation in which a theoretical sink point is used is derived first for an infinite flow field, and then for a rectangular flow field as a general type. The case where the conduit is not filled with water is also considered. An approximate equation for a rectangular flow field is presented, using the Jacobian elliptic function. The accuracy of these investigations is confirmed experimentally by tests conducted on an electrical analog model and a sand model. (Knapp-USGS)
W71-01933

STATISTICAL DETERMINATION OF PERMEABILITY BY THE PORE SIZE DISTRIBUTION IN POROUS MEDIA,
Osaka Univ. (Japan). Dept. of Civil Engineering; and Osaka Prefectural Technical Coll., Neyagawa (Japan).
Akira Murota, and Kuniaki Sato.
French synopsis. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 183-190, 1969. 8 p, 7 fig.

Descriptors: *Flow, *Porous media, *Groundwater movement, *Absorption, *Capillary water, Darcys law, Viscosity, Adhesion, Seepage, Soil water movement, Fluid mechanics, Porosity, Permeability, Particle shape, Particle size.
Identifiers: *Pore size distribution, Sorting, Pore shape, Pore size.

Estimation of permeability includes some obscurities, particularly in expression of a representative grain size and in dealing with absorbed water. In order to introduce the effect of absorbed water, a microscopic flow-field of fluid molecules is assumed in which a coefficient of high-viscosity is adopted. The flow patterns of seepage are phenomenally classified into three regions by characteristic pore sizes: the non-seeping, the high-viscous, and Darcy's flow region. Expressions are presented for permeability in each region. (Knapp-USGS)
W71-01934

GENERAL CHARACTERIZATION OF DIFFERENT TYPES OF SEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01935

A STUDY ON THE SEEPAGE FLOW OUT OF A FRESH WATER CANAL IN THE GROUND SATURATED WITH SEA WATER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W71-01943

FILTRATION PROBLEMS OF IRRIGATING AND WASHING SALINIZED SOILS,
Akademiya Nauk SSSR, Novosibirsk.
P. Ya. Polubarinova-Kochina, V. I. Penkovsky, S. T. Rybakova, and V. N. Emikh.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 77-84, 1969. 8 p, 6 fig.

Descriptors: *Irrigation water, *Leaching, *Drainage systems, *Saline soils, Diffusion, Groundwater movement, Mathematical studies, Drainage engineering, Drainage water, Irrigation programs, Outlets, Laterals, Water management (Applied).
Identifiers: USSR.

The study of desalinization of soils by washing gave rise to a number of problems including dissolving salts, the behavior of salts in groundwater, diffusion, physico-chemical phenomena, and the water filtration rate in the washing process. Salinized soils are mostly washed by flooding a certain area with subsequent draining of wash water into open or closed tubular horizontal outlets. The solution obtained is expressed in a parametric form in terms of elliptic integrals. The diffusion equation can be integrated numerically and gives the salinity distribution at different times. (Knapp-USGS)
W71-01945

SEEPAGE LAW FOR MICROSEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 04A.
W71-01950

ADVANCE OF IRRIGATION WATER ON THE SOIL SURFACE IN RELATION TO SOIL INFILTRATION RATE: A MATHEMATICAL AND LABORATORY MODEL STUDY,
Iowa State Univ., Ames. Dept. of Agronomy.
Mohamed Asseed, and Don Kirkham.
Iowa State University Agriculture and Home Economics Experiment Station Research Bulletin 565, p 293-317, September 1968. 25 p, 24 fig, 1 tab, 33 ref. OWRR Project A-003-IA (13).

Descriptors: *Irrigation water, *Soil surfaces, *Infiltration, *Soil water movement, *Model studies, Soil moisture, Mathematical studies, Equations, Laboratory tests, Soils, Soil density, Porous media, Storage capacity, Permeability, Resistivity, Hydraulics, Topography.
Identifiers: *Iowa State University.

Mathematical equations describing the horizontal advance of an irrigation stream on a soil surface are derived and discussed for different types of infiltration equations corresponding to different known field conditions. Complex variable theory is applied to transform certain complicated forms of infiltration equation solutions to algebraic forms. An irrigation model having a visible Plexiglas photographic front was constructed and operated to test the theory and obtain data not covered by the theory. Glass beads or soil aggregates constitute the porous medium; water is used as the seepage fluid. Potassium dichromate dye is injected into the porous medium to trace the direction and velocity of the stream lines when the water moves within the body of the porous medium. The model data are recorded by photography and show a good agreement between theory and experiment for both the calculated position of the 'irrigation' front on the porous media and the 'wetted' front below the surface. Comparisons were made between experimental data and theory for two slopes of land, for five porous media, for two irrigation rates, and for two surface conditions, rough and smooth. Dimensionless functions are developed to present the model data. (Knapp-USGS)
W71-01964

KINETICS AND ENERGETICS OF ADSORPTION AND DESORPTION OF MINERAL NUTRIENTS FROM SOIL MINERALS,
Utah Agricultural Experiment Station, Logan.
R. L. Smith.
Available from NTIS as COO 139211, $3.00 in paper copy, $0.95 in microfiche. March 9, 1970. 7 p, 8 fig, 1 ref. Contract AT (11-1)-1392-5.
Identifiers: *Soils, Adsorption, Thermodynamics, Kinetic theory, Desorption, *Soil chemistry, Nutrients.

In principle, obtaining kinetic data of ion adsorption by mineral surfaces is simple. The procedure is to determine how the ion concentration in solution varies with time in the presence of a given amount of solid, holding the temperature of the system constant. However, usually the solid phase must be separated from the aqueous phase before the ion concentration is determined. This is usually done by removing the sample from the thermostat (water bath) centrifuging it in a temperature-controlled high speed centrifuge (plus or minus 1C) and analyzing the supernatant liquid. Because of the time involved and the lack of precision temperature control using the high speed centrifuge, accurate kinetic data, involving short reaction times, are precluded. The past year was dedicated to a study of experimental techniques which would allow elimination of the centrifuge in adsorption kinetic. The feasibility of using a dialysis membrane bag to separate the solid from the aqueous solution was investigated. The membrane allows the free diffusion of ions in solution but restrains the solid phase with the bag. The aqueous solution can then be readily pipetted from a reaction flask and analyzed without removing the reaction flask from the water bath.
W71-01991

THE EFFECTS OF FARMYARD MANURE ON MATRIC SUCTIONS PREVAILING IN A SANDY LOAM SOIL,
National Vegetable Research Station, Wellesbourne (England).
For primary bibliographic entry see Field 05D.
W71-02034

2H. Lakes

THE CYCLOPID FAUNA OF THE LITTORAL ZONE OF RYBINSK RESERVOIR,
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
A. V. Monakov.
Trans. From: (Biologiya I Troficheskie Svyazi Presnovodnykh Bespozvonochnykh I Ryb. Sbornik Statei. Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, No. 17 (20), 'Nauka', Leningrad, 1968, pp 33-40. Available from NTIS as PB-189 892T, $3.00 in paper copy, $0.95 in microfiche. Russian trans by Narragansett Marine Game Fish Research Lab, June 1969. 11 p, 19 ref.
Identifiers: *Crustacea, *Lakes, *Plankton, Lakes, Population, Ecology, Food, Nutrition, Distribution, Marine biology, USSR, *Cyclopids, Food chains, *Phytoplankton.

Twenty-six species of cyclops live in the littoral zone of Rybinsk Reservoir, of which the most numerous four are: Acanthocyclops viridis, Macrocyciops albidus, Microcyclops varicans and M. bicolor. The degree of overgrowth and the depth of the littoral zone are factors which determine the composition, abundance and distribution of cyclopids. The maximal abundance and greatest number of species are seen in the shallows which are overgrown with sedges and horsetails; the minimal - at greater depths among the reeds. The total biomass of cyclops during the period from May through October undergoes considerable fluctuations, but provides two clearly expressed maximums: the first - with a biomass of 0.35 g/m3 at the end of May, two weeks after flooding of the littoral zone; the second - with a biomass of 0.4 g/m3 at the end of August. Two species chiefly specify the quantity of the total biomass - Acanthocyclops viridis and Macrocyclops albidus. The middle of summer is characterized by numerical predominance of the small phytophilic species of Microcyclops and forms of the pelagic plankton - Mesocyclops leuckarti.
W71-01663

RADIOCESIUM KINETICS IN THE COMPONENTS OF A MONTANE LAKE ECOSYSTEM,
Colorado State Univ., Fort Collins. Dept. of Radiology and Radiation Biology.
Anthony F. Gallegos.
Available from NTIS as COO-115 634, $3.00 in paper copy, $0.95 in microfiche. Ph. D. Thesis, Colorado State Univ, December 1969. 342 p, 79 tab, 29 fig, 99 ref, append. AEC AT (11-1)-1156.
Identifiers: *Lakes, *Ecology, *Radioactive isotopes, Lakes, Retention, Fishes, Cesium.

Combined laboratory aquarium and lake observations with important components in the East Twin Lake ecosystem were utilized in the synthesis of a radiocesium kinetics compartment model for predicting the build-up of this radionuclide in the tissues of fish and other components at the lake. Analysis of Cs-137 build-up data in fish obtained from the lake by a postulated biological model showed that the required daily intake of radiocesium was about ten times greater than that obtained from their food sources. Close to 80 per cent of the diet of rainbow trout in ETL consisted of Gammarus lacustris, while most of the remainder consisted of Daphnia pulex. Sediment uptake by fish is postuted as the major cause of radiocesium build-up in fish at ETL, as 20 to 40 per cent of the absorbed radiocesium is removed by the gut of rainbow trout. Qualitative identification of feldspars and quartz in the stomach and intestinal contents of rainbow trout from ETL also lends support to this theory. In addition to the compartment model synthesis for various components at ETL, a chronic ingestion model was also derived for rainbow trout at ETL utilizing the Cs-137 build-up data, Cs-134 excretion experiments in rainbow trout, and Cs-134 tissue distribution studies on these fish. The effect of temperature and weight of fish on the retention of radiocesium by rainbow trout was studied in a laboratory aquarium system designed to have refrigeration capacity, and to provide for treatment of solid and dissolved organic matter derived from fish wastes. A weight/temperature interaction term was shown to affect the overall excretion pattern of radiocesium as a function of time. Retention half-times of the long component in these fish were observed to be affected not only by a weight/temperature interaction term, but also by the per cent weight increase of the fish during the test interval. Laboratory experiments with Gammarus lacustris in aquaria contaminated with Cs-134 showed that the concentration factor of these organisms at equilibrium was largely dependent on the water radiocesium concentration. Limnological studies at ETL provided most of the necessary information required for proper description of this ecosystem in terms of radiocesium movement and pool size estimates. The total Cs-137 inventory of ETL was estimated to be 10 mCi.
W71-01671

STATE V TIMOTHY (DOCTRINE OF PURPRESTURE LIMITS PRIVATE CONSTRUCTION ON LAKE BED).
For primary bibliographic entry see Field 06E.
W71-01673

DYNAMICS OF ABUNDANCE OF GENERATIONS AND THE GROWTH OF THE BREAM IN KUIBYSHEV RESERVOIR,
Bureau of Sport Fisheries and Wildlife, Narragansett, R. I. Narragansett Marine Game Fish Research Lab.
I. V. Sharonov.
Available from NTIS as PB-189 130T, $3.00 in paper copy, $0.95 in microfiche. Biologiya i troficheskie svyazi presnovodnykh bespozvonochnykh i rby. Sbornik statei. Akademiya Nauk SSSR, institut biologii vnutrennikh vod, trudy, no. 17 (20), 'Nauka', Leningrad, 1968. p 151-179. Transl. of Narragansett Marine Game Fish Reasearch Lab., July, 1969. 38 p, 62 ref.
Identifiers: *Fishes, USSR, Abundance, Ecology, Growth, Dams, Sampling, Reproduction, Physiology, Eggs, Bream, Kuibyshev reservoir, Spawning.

Among the commercial fishes of Kuibyshev Reservoir, the bream occupies first place. According to the plan for fishery development, the catch of bream must comprise 35 percent of the total fish yield, and the reservoir must remain a typical bream water. If the ecological spectrum of a species at all stages of development corresponds to the new conditions, then its population flourishes and its abundance increases. Change of living conditions causes changes in the biological indices of a population, including the periods of onset of sexual maturity and the period of reproduction, fertility, growth rate, structure and density. Clarification of these phenomena in their interconnection with the conditions which arise in a new body of water helps one to see into the nature of the process of formation of a stock, and facilitates the development of measures for increasing the abundance of a population and the most rational exploitation of it for economic interests.
W71-01675

STOCK ASSESSMENT BY ECHO INTEGRATION AND ITS APPLICATION TO JUVENILE SOCKEYE SALMON IN LAKE WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
Richard E. Thorne, and James C. Woodey.
Available from NTIS as PB-190 366, $3.00 in paper copy, $0.95 in microfiche. January 28, 1970. Circular No. 70-2.
Identifiers: Lake Washington (Wash), Washington, Salmon, Echo integrators, Fish surveys, Onchorhynchus nerka, *Fishes, Counting methods, *Echo ranging, Fishes, Population, Abundance, Underwater sound signals, Transducers, Detectors, Ultrasonic radiation, Depth finding, Lakes, Theses.

An echo integrator for use in the estimation of fish populations was designed and built. The first part of this paper describes an investigation into the relationship between the integrated echo strength of the echo integrator and number of juvenile sockeye salmon. The second part details an estimation of the pelagial population of presmolt sockeye salmon in Lake Washington by means of the echo integrator.
W71-01678

ALKALINITY AND FORMATION OF ZEOLITES IN SALINE ALKALINE LAKES,
Wyoming Univ., Laramie. Dept. of Geology.
Robert H. Mariner, and Ronald C. Surdam.
Science, Vol 170, No 3961, p 977-980, November 1970. 4 p, 3 fig, 1 tab, 19 ref. American Chemical Society Grant 3809-A2 PRF-ACS.

Descriptors: *Zeolites, *Alkaline water, *Lakes, *Gels, Model studies, Silicates, Sedimentary tuff, Rhyolites, Saline water, Chemical precipitation.
Identifiers: *Silica solubility, Zeolite mineralogy.

Where authigenic silicates are forming today, a relationship has been noted between the Si/Al ratio of the low-temperature zeolitic alteration products of silicic glass and the alkalinity of lake waters responsible for that alteration. A model is suggested to explain the relationship. The solubility of rhyolitic glass increases with increasing alkalinity, whereas the ratio of silicon to aluminum decreases with increasing alkalinity. Strong correlation observed between alkalinity and zeolite mineralogy in saline, alkaline lakes is a function of the relationship between pH and the Si/Al ratio. This function is probably a result of the reaction between silicic glass and alkaline solution whereby (1) a gel forms, whose Si/Al ratio is controlled by the Si/Al ratio of the solution, and (2) a zeolite forms from the gel,

hose Si/Al ratio is, in turn, controlled by the composition of the gel. (Land-USGS)
W71-01903

HE PREDICTION OF WITHDRAWAL LAYER HICKNESS IN DENSITY STRATIFIED RESERVOIRS,
ennessee Valley Authority, Norris. Engineering ab.
ex A. Elder, and Walter O. Wunderlich.
rench resume. In: Proceedings 13th Congress of he International Association for Hydraulic esearch, Kyoto, Japan, August 31-September 5, 969, Vol 2, (Subject B), Science Council of apan, Kyoto, p 309-316, 1969. 8p, 3 fig, 2 tab, 5 ef.

escriptors: *Forecasting, *Withdrawal, *Boundary layers, *Density stratification, *Reservoirs, Consumptive use, Water, Interfaces, Flow, Profiles, Mathematics, Equations, Water analysis, Remote ensing, Model studies, Electrodialysis.
dentifiers: Field and laboratory data relationships, ennessee Valley Authority, Sensor.

irect measurements of the withdrawal layer hickness and its internal velocity distribution were ade by the Tennessee Valley Authority in two of s large reservoirs. These reservoirs (Fontana and herokee) have very different geometry. The meaurements were made using a 'Deep Water Isotopic urrent Analyzer'. Integration of the measured elocity profiles over depth and width of the ithdrawal layer yielded flow rates in good agreeent with the powerhouse discharges. Extending he integration over the temperature profile yielded result in good agreement with the outflow temeratures. Equations which have been proposed for he prediction of the withdrawal layer thickness nd flow distribution were checked for their aplicability to the field data. Although the results obained up to now are not entirely conclusive and nore tests need to be conducted, valuable exeriences were gained for immediate application in ater quality prediction models. (Woodard-USGS)
W71-01954

COLORADO TROUT LAKE STUDIES,
Colorado Dept. of Natural Resources, Fort Collins.
Wesley C. Nelson.
Available from NTIS as TID-25342, $3.00 in paper copy, $0.95 in microfiche. Progress Report for 1969, 20 Jan 70. 12 p, 6 ref.

Descriptors: Colorado.
Identifiers: *Lakes, *Ecology, *Fishes, Lakes, *Radiological contamination, Limnology.

Limnological measurements were made on water temperature, depth of secchi disk visibility and dissolved oxygen concentrations. All fish caught were identified, sexed, weighed, and measured, and representative samples were taken for analysis of 137Cs concentrations in muscle tissue. Results of studies on three lakes are tabulated. Mean concentrations of 137Cs remained relatively high in rainbow trout from Lower Agnes Lake, and cutthroat trout from Upper Snow Lake. From these results it is concluded that in the event of renewed contamination of the environment by radioactive fallout, the larger fish from similar montane and alpine lakes would present the greatest potential health hazard if caught and consumed by fishermen.
W71-01989

SEA GRANT ACTIVITIES.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 09D.
W71-02054

CITY OF SHREVEPORT V WILKINSON (CONSTITUTIONALITY OF ORDINANCE DENYING ACCESS TO LANDOWNER'S HOME).
For primary bibliographic entry see Field 06E.
W71-02169

2I. Water in Plants

STUDIES ON THE INFLUENCE OF MIST IRRIGATION ON THE MICROENVIRONMENT, GROWTH, AND DEVELOPMENT OF THE POTATO (SOLANUM TUBEROSUM),
Minnesota Univ., Minneapolis.
Douglas Charles Sanders.
Ph D Thesis, University of Minnesota, December, 1970. 112 p, 3 tab, 4 fig, 18 ref. OWRR Project B-013-MINN (1).

Descriptors: Plants, *Potatoes, *Moisture stress, *Irrigation, *Irrigation effects, Crops responses, Plant growth, Soil-water-plant relationships, Irrigation practices.

The influence of irrigation method on the microenvironment, growth and development, foiliage nutrient content, and tuber quality of the potato was assessed during three seasons. Low volume 'mist' irrigation (M), furrow irrigation (F), mist plus furrow (MF) and no irrigation (NI) were compared. Misted (M) canopies had lower leaf, air, and soil temperatures and higher soil moisture than NI canopies. Stomata of misted plants did not close as rapidly as those of non-irrigated plants. During high and moderate stress seasons misting delayed haulm senescence and increased the proportion of small and medium size tubers. Further during the high stress season the misted plots yielded more than NI plots. During the latter part of two seasons the leaves from NI plots contained less P and K and more Fe than leaves from M and MF plots. Leaves from F treated plots were similar to those from NI treated plots in nutrient content except that P was lower in the latter. Leaves and petioles of M and MF plants consistently contained more Zn than those of NI or F plants throughout all three seasons. Tubers from misted treatments (M and MF) tended to be lower in dry matter, had a high incidence of secondary growth and hollowheart, yielded darker chips, required more time to recondition, were less mature and contained more reducing sugars than those from NI treatments. Further the tubers from misted treatments contained more P, Mg, Ca, Fe, Al, B and Mn than those from NI plots at various times during the latter part of the season. Mist irrigation can be a viable means of reducing internal plant moisture stress and increasing yields of potatoes.
W71-01656

PART I, CONTROLLING THE SOIL MOISTURE ENVIRONMENT OF TRANSPIRING PLANTS, PART II, PREDICTION OF LEAF TEMPERATURE UNDER NATURAL ATMOSPHERIC CONDITIONS,
Kentucky Water Resources Inst., Lexington.
Charles T. Haan, Billy J. Barfield, and Robert Edling.
Available from NTIS as PB-195 831, $3.00 in paper copy, $0.95 in microfiche. Research Report No. 30, 1970. 67 p, 7 tab, 17 fig, 29 ref. OWRR Project A-017-KY (1).

Descriptors: *Transpiration, *Soil moisture, Micrometeorology, Plants, Soil-water-plant relationships, Temperature, Energy budget, Evaporation, Transpiration control.
Identifiers: *Leaf temperature, Mist irrigation, Plant root zone.

Part I: A technique for controlling the soil moisture potential in the root zone of transpiring plants was developed. The method uses the principles of unsaturated flow through a porous media to develop the desired moisture potential. In the case of nonsteady state transpiration, the maximum possible fluctuation in the soil moisture potential can be determined by the techniques presented. Part II: Two implicit leaf temperature prediction equations were derived from the energy balance approach. The equations define sensible and latent heat transfer from a plant population as a two step process: (1) Transfer between the plant leaf and the canopy bulk air, and; (2) transfer between the canopy bulk air and the atmosphere. Boundary layer concepts were applied to leaf heat transfer in both equations. Turbulent atmospheric transfer by free and forced convection were considered. Measurements of leaf temperature and wind velocity, temperature and humidity profiles for a cucumber plot were taken during ten tests. Richardson numbers to classify atmospheric stability were determined. The neutral wind velocity profile parameters, roughness height and zero displacement height were determined by a computerized least squares technique using data from the ten tests. Calculated Richardson's numbers indicated transfer by free convection. Comparison of predicted and meausred leaf temperatures revealed the forced convection prediction equations considerably over estimated leaf temperature while the free convection predictions was much more accurate.
W71-01660

THE INFLUENCE OF GROUNDWATER SALINITY ON PLANT GROWTH,
Arizona Univ., Tucson. Environmental Research Lab.
For primary bibliographic entry see Field 02F.
W71-01701

OSMOTIC AND 'TOXIC' EFFECTS OF SALINITY ON GERMINATION OF PHASEOLUS VULGARIS L. SEEDS,
Arizona Univ., Tucson. Environmental Research Lab.
Jose Tarquinio Prisco, and James W. O'Leary.
Turrialba, Vol 20, No 2, p 177-184, April-June 1970. 6 tab, 31 ref.

Descriptors: *Absorption, *Toxicity, *Osmotic pressure, *Germination, *Seeds, Sodium chloride, Salt tolerance, Laboratory tests, Plant growth, Beans, Saline soils, Root systems.
Identifiers: *Water potential, *Radicle emergence, *Carbowax, *Matric potential, *Imbibition, Kidney beans.

In studying the effects of saline substrates on seeds it is important to differentiate between simultaneously operating toxic and osmotic effects. Red kidney bean seeds were exposed to nutrient media containing either NaCl or Carbowax 1540 at water potentials of 0, -2, -4, -8, -12 and -16 bars. Effects on water absorption, radicle emergence, seed germination and seedling development were measured. At 6 hrs, seeds in both NaCl and Carbowax solutions revealed no differences in water absorption regardless of solution water potential. After 12 hrs, significantly less seed water absorption occurred in NaCl solutions of -8 bars or less, while all Carbowax solutions showed less absorption. This suggest that up to 12 hrs, water absorption was mainly a function of seed matric potential and was thereafter dependent on osmotic potential. Differences between Carbowax and NaCl were due to NaCl seed penetrability followed by osmotic adjustment. At -12 bars and lower, fewer radicles emerged in NaCl than Carbowax solutions, indicating toxic effects of NaCl at these higher salinity levels. Since most emerged radicles did not continue to germination, it was felt that radicle emergence is an inadequate germination criterion. Carbowax affects root growth more than shoot growth while the opposite is true for NaCl. Carbowax 1540 does not appear to be phytotoxic. (Casey-Arizona)
W71-01702

SUBSURFACE APPLICATION AND SHALLOW INCORPORATION OF HERBICIDES ON COTTON,
Southwestern Great Plains Research Center, Bushland, Tex.
A. F. Wiese, and E. B. Hudspeth, Jr.
Texas Agricultural Experiment Station, Technical Article 5989. Weed Science, Vol 16, No 4, October 1968, p 494-498. 7 tab, 1 fig, 11 ref.

Descriptors: *Herbicides, *Weed control, *Cotton, *Crop production, *Plant growth regulators, Crop

response, Rainfall, Arid lands, Application methods, Spraying, Equipment, Soil types, Soil surfaces, Texas.
Identifiers: *Herbicide application, *Herbicide incorporation, *Herbicide performance, *Crop management, Diuron, Prometryne, Norea, DCPA, Fluometuron, Trifluralin.

Herbicides left on soil surface in dry areas frequently disappear before rain occurs. This 3-year study was to determine if various incorporation methods would improve herbicide performance over a wide range of conditions. Subsurface application just ahead of a planter with a device that removed the top from the bed, applied a spray, and covered it with soil reduced weed control in cotton more than surface applications. Sprays consisted of diuron, prometryne, norea, DCPA, fluometuron and trifluralin. The machine improved weed control with trifluralin. After planting shallow incorporation with two helical blades increased weed control with trifluralin, diuron, and DCPA by 10 percent or more over the surface application. This incorporator increased by 5 percent weed control obtained with prometryne and norea. Very shallow incorporation with metal tines after planting improved weed control obtained with trifluralin and DCPA by 18 and 11 percent. Weed control with norea was increased 7 percent. Compared to surface application, incorporation increased cotton injury with diuron, norea, prometryne and fluometuron on sandy loam soil. A figure shows applicators and incorporators and 7 tables quantify the relationships. (Popkin-Arizona)
W71-01704

COMPARATIVE PHOTOSYNTHESIS, GROWTH AND TRANSPIRATION OF TWO SPECIES OF ATRIPLEX,
Australian National Univ., Canberra. Research School of Biological Sciences.
R. O. Slatyer.
Planta (Berlin), Vol 93, No 3, p 175-189, 1970. 4 fig, 1 tab, 19 ref.

Descriptors: *Photosynthesis, *Transpiration, *Plant growth, *Leaves, *Stomata, Xerophytes, Carbon dioxide, Permeability, Resistance, Biological communities, Water conservation, Water utilization, Efficiencies, Physiological ecology, Plant physiology, Metabolism, Laboratory tests, Growth rates.
Identifiers: *Assimilation, *Seedlings, Mesophytes.

To compare photosynthetic efficiency as a function of water use in both single leaves and whole plants, seedlings of 2 species of Atriplex were studied--spongiosa (xerophytic C sub 4) and hastata (mesophytic C sub 3). Initially, spongiosa showed higher growth rate, assimilation rate and water use efficiency and lower transpiration rate. These were reflected in greater leaf area. As the experiment progressed (over 23 days), spongiosa/hastata ratios of growth and leaf area declined steeply to less than 1.0 while the assimilation ratio declined slightly to 1.0. Water use efficiency and transpiration rate ratios remained relatively constant both in seedlings and single leaves. These results indicated that the C sub 4 species was capable of more efficient photosynthesis but that this is only one minor factor in total growth rate. Mesophyll resistance (r sub m) was consistently lower in spongiosa while stomatal resistance (r sub l) was consistently higher. Both increased with time. Comparable water exchange and carbon dioxide exchange values in single leaves and seedlings provide a more rational basis for interpreting single leaf responses in terms of whole plant and community data. Spongiosa produces photosynthate more efficiently in critical early growth stages. An efficient photosynthetic apparatus (low r sub m) combined with a relatively impermeable gas pathway (high r sub l) reveal an elegant aridity adaptation. (Casey-Arizona)
W71-01708

THE VEGETATION OF SUPERFICIAL IRONSTONE HARDPANS IN SIERRA LEONE,
Bristol Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 02G.
W71-01710

THE INFLUENCE OF TILLAGE PRACTICES ON YIELDS AND WEED CONTROL IN SAFFLOWER,
Nebraska Univ., Lincoln. Dept. of Agronomy; and Lincoln Univ., Mitchell. Scotts Bluff Experiment Station.
C. R. Fenster, and L. R. Robison.
Nebraska Agricultural Experiment Station, Journal Series Paper No 2205. Weed Science, Vol 16, No 3, July 1968, p 326-328. 2 tab, 6 ref.

Descriptors: *Cultivation, *Crop production, *Weed control, *Safflower, *Economic efficiency, Plant growth regulators, Soil moisture, Moisture content, Humidity, Semiarid climates, Arid climates.
Identifiers: *Tillage practices, *Crop management, *Tillage tools, Sweep machine, Oneway plow, Moldboard plow, Plots.

Dry atmospheric conditions (low relative humidity) and adequate soil moisture are necessary during the growing season of safflower for economical production. An experiment to investigate tillage practices for producing safflower and controlling weeds was conducted from 1963 to 1965. Three tillage intensities (excessive, moderate, minimum) depending on the number and kind of tillage operations were used. Three different tillage tools used as primary preparation implements were sweep machine, oneway and moldboard plow. Excessive, moderate and minimum tillage plots averaged 342, 374 and 413 lb/A of safflower and 72, 73, and 63 lb/A of weeds. Sweep machine plots produced the highest safflower yields and lowest weed yields at all intensities, with the oneway and moldboard plow about the same. Yields produced from the best treatment in the experiment (minimum tillage with the sweep machine and seeding with the shoe drill) averaged 300 lb/A more than commercial fields and weed control was effective. Tables show weed and safflower yields under three different tillage regimes. (Popkin-Arizona)
W71-01711

PRODUCTIVITY STUDIES ON HEATH VEGETATION IN SOUTHERN AUSTRALIA. THE USE OF FERTILIZER IN STUDIES OF PRODUCTION PROCESSES,
Melbourne Univ., Parkville (Australia). Dept. of Botany.
Richard Jones.
Folia Geobotanica et Phytotaxonomica, Vol 3, No 4, p 355-362, 1968. 5 tab, 7 ref.

Descriptors: *Productivity, *Biomass, *Fertilizers, *Leaves, *Plant growth, Semiarid climates, Phosphates, Nitrogen, On-site investigations, Biological communities, Ecosystems, Data collections, Vegetation, Crop production, Nutrients.
Identifiers: *Heaths, *Leaf area, *Australia.

Australian heaths are low in plant productivity because of low soil nutrient status. As a prelude to a study on fertilizer effects on water use, the fertilizer effects on above-and below-ground plant parts, including leaf area, were studied in a heath community. Square plots of 10 m sides were established and half were randomly fertilized with superphosphate (1000 kg/ha). An analysis of variance was performed on yield data. Increases in biomass and leaf area were minimal for the first 2 years after application. There was no demonstrable fertilizer effect on below-ground growth. It is felt that a permanently detectable indication of increased growth may only be possible after several years of annual application. (Casey-Arizona)
W71-01712

IS ANY ANGIOSPERM AN OBLIGATE HALOPHYTE,
California Univ., Davis. Dept. of Botany.
Michael G. Barbour.
American Midland Naturalist, Vol 84, No 1, p 105-120, 1970. 1 fig, 68 ref.

Descriptors: *Halophytes, *Salt tolerance, *Reproduction, *Plant growth, *Reviews, Ecology, Arid lands, Salt marshes, Marine plants, Estuarine environment, Coastal marshes, Mangrove swamps, Osmotic pressure, Toxicity, Plant groupings, Plant physiology, Environmental effects, Ecosystems, Saline soils, Saline water, Xerophytes.
Identifiers: *Glycophytes, *Angiosperms.

All growing plants require at least some salts, but the literature on halophytes has failed to establish definitive criteria on the basis of absolute salt level requirements. Three types of halophyte are considered: (1) intolerant-grows in a 0.1% or less saline medium and growth declines as salinity increases; (2) facultative-optimal growth at moderate salinity (greater than 0.2%) and growth declines on both sides of the optimal level and (3) obligate-optimal growth at moderate and high salinities with declining growth as salinity decreases. The existing literature, incorporating both field and lab data, offers few thorough studies as guidance in determining the existence and relative distribution of these categories. Studies are either insufficient involving only short-term effects, or they ignore interacting variables such as salt toxicity and osmotic effects. Reproduction is also neglected, which is critical, since ability to reproduce rather than short-term growth should be the main criterion of salt tolerance. The literature is reviewed on marine angiosperms, mangroves, coastal strand plants, desert plants and salt marsh plants. Although some plants are demonstrably facultative halophytes, there is no hard evidence for the existence of any obligate halophytes. (Casey-Arizona)
W71-01714

CAN THERE BE A POSITIVE WATER POTENTIAL IN PLANTS,
Arizona Univ., Tucson. Dept. of Biological Sciences.
James W. O'Leary.
BioScience, Vol 20, No 15, p 858-859, 1 August 1970. 7 ref.

Descriptors: *Water balance, *Osmotic pressure, *Turgidity, *Soil-water-plant relationships, Xylem, Roots, Vascular tissues, Soil water, Transpiration, Exudation, Plant physiology, Circulation (Plants), Movement, Mode of action, Water circulation.
Identifiers: *Water potential, *Root pressure, *Guttation.

Investigators have recently allowed for the possibility of a positive plant water potential. In asserting that this is impossible, the author examines 3 situations in which it would be most likely to occur. High root pressures often result in exudates from cut stumps or leaf margins. This does not imply a positive water potential because water movements across the root occur in response to the higher osmotic pressure of the xylem fluid. If the roots were in pure free water, there would be a flow down a potential gradient into the xylem fluid until turgor pressure equalled osmotic pressure. The water potential would then be zero and flow would cease, preventing the attainment of a positive water potential. The possibility of an 'active pump' in the roots is considered and discarded for lack of evidence. The last possibility is the removal of salts in the sap stream, but this will be accompanied by water diffusion into living cells along the pathway. In any case the upper limit for plant water potential is set by soil water potential which should never be greater than zero in the vicinity of the roots. (Casey-Arizona)
W71-01718

MICROCLIMATE BEFORE AND AFTER IRRIGATION,
Washington Univ., Seattle. Coll. of Forest Resources.
Leo J. Fritschen, and Paul R. Nixon.
AAAS, Section on Applications of Ground Level Climatology, Annual Meeting, Berkely, Calif., Dec 27-30, 1965, paper presented. American Association for the Advancement of Science, Washington D.C., Publication No 86, p 351-366, 1967. 4 fig, 9 tab, 14 ref.

Descriptors: *Microclimatology, *Vapor pressure, Solar radiation, *Arid lands, *Irrigation effects, On-site investigations, Heat budget, Thermal stratification, Latent heat, Evaporation, Advection, Convection, Arizona, California, Temperature, Soil surfaces, Turbulent boundary layers, Infrared radiation, Soil-water-plant relationships, Soil temperature, Root systems, Air temperature, Dew point, Humidity, Reservoirs, Energy balance, Sampling, Irrigated lands, Surface waters, Radiation.
Identifiers: *Potential evapotranspiration, *Point samples, *Transects, *Air space, *Sensible heat, Soil heat flux, USSR, Net radiation, Water surfaces, Oases, Salt River Valley (Ariz).

Irrigation effects on arid zone microclmates involving energy balance, vapor pressure and temperature were determined by field investigations and literature reviews of large and small irrigation oases in the U.S. and USSR. Both point sampling and transect methods were used. Energy balance components on an experimental field (73x92m) in the Salt River Valley, Arizona, were measured over open water and wet and dry bare soil. Evaporation from wet bare soil exceeded that from open water due to a greater surface-to-air vapor pressure gradient. In both large and small irrigated areas the microclimate is locally modified, the air being cooler and more humid to about 1.5m above ground surface. In supporting evaporation, irrigated areas utilized solar radiation and also extracted energy from local air masses. Due to vertical energy gradients, advection in arid lands is minimal. The various effects of irrigation are therefore compensatory and of limited areal extent and duration. These data were supported by results from a transect area in the San Joaquin Valley, California. The measured energy balance components may be used to calculate potential evapotranspiration which is useful in planning irrigation developments. (Casey-Arizona)
W71-01720

STATUS OF RESEARCH AND EDUCATION IN FOREST HYDROLOGY,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
William E. Sopper.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 744-776, published by Univ of Illinois, 1969. 33 p, 2 fig, 2 tab, 40 ref. OWRR Project A-006-PA.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Forestry, *Forest management, Research and development, Water resources development, Forecasting, Hydrology, Hydraulics, Water Yield improvement, Conservation, Hydrogeology, Planning, Projects, Research facilities, Exploration, Economics, Evapotranspiration, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Forest hydrology.

There are about 650 million acres (260 million ha.) of forest land in the contermineous United States, representing slightly more than one-third of the total area. It is estimated that these forested areas receive well over one-half the total precipitation falling in the United States and may contribute nearly three-fourths of the total streamflow in this country. Much of the forest occupies rugged mountainous areas which under misuse or poor management can lead to disastrous results as evidenced by the disappearance of past civilizations due to their failure to recognize the importance of the forested watershed, its vegetative cover, and its hydrologic behavior. Much of the husbandry of our forests and wildlands, which produce most of the Nation's total streamflow, is entrusted to professional resource managers, primarily foresters and range managers. Response to the need for additional academic training in the water resource field is shown by the large increase in formal courses related to watershed management. Graduate programs in forest hydrology through the doctorate degree are now available at almost one-half of the accredited forestry schools. Almost all of these programs are inter-disciplinary and in addition to the water-related courses offered in the forestry school also generally require courses of civil engineering (hydrology and hydraulics), soil science (agronomy), geology and hydrogeology, meteorology and hydrometeorology, botany (plant physiology), and geography (climatology). Broad-based programs may even include course in natural resource management, land-use planning, water law, and natural resource economics. (Knapp-USGS)
W71-01829

MICROBIAL DEGRADATION OF ORGANIC POLLUTANTS OF INDUSTRIAL ORIGIN,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05C.
W71-01898

CONSUMPTIVE USE OF WATER BY SUGARCANE IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-01902

2J. Erosion and Sedimentation

RELATIVE EFFECT OF WAVES GENERATED BY LARGE SHIPS AND SMALL BOATS IN RESTRICTED WATERWAYS,
California Univ., Berkeley, Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01664

CONTINUED EVALUATION OF ROADSIDE DEVELOPMENT AND EROSION CONTROL EXPERIMENTS. PART I. CAUSES AND CONTROL OF SOIL EROSION ON OKLAHOMA HIGHWAYS. PART II. MAINTENANCE OF VEGETATIVE GROUND COVERS ON OKLAHOMA HIGHWAYS. PART III. WEED CONTROL AND ERADICATION ON OKLAHOMA HIGHWAYS,
Oklahoma Agricultural Experiment Station, Stillwater.
For primary bibliographic entry see Field 04C.
W71-01681

EOLIAN SEDIMENT INFLUENCE ON PEDOGENESIS DURING THE QUATERNARY,
Wisconsin Univ., Madison. Department of Soil Science; Chicago Univ., Ill.; and California Univ., Riverside. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02G.
W71-01709

OPEN CHANNEL EXPANSIONS FITTED WITH LOCAL HUMP,
Sir George Williams Univ., Montreal (Quebec); And Indian Inst. of Science, Bangalore.
For primary bibliographic entry see Field 08B.
W71-01731

SOME MORPHOMETRICAL RELATIONSHIPS IN THE MIDDLE AND LOWER REACHES OF THE AMU DARYA,
Sredneazuatsjuu Bauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
For primary bibliographic entry see Field 08B.
W71-01779

MORPHOLOGICAL PRINCIPLE OF MODELLING RIVER-BED PROCESS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 08B.
W71-01780

A BASIC CAUSE OF A BRAIDED CHANNEL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. W. Shen, and S. Vedula.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 201-205, 1969. 5 p, 1 fig, 1 ref. NSF Research Grant GK-0549.

Descriptors: *Sediment transport, *Alluvial channels, *Braiding, *Hydraulic models, Deposition (Sediments), Meanders, Sedimentation, Bed load, Provenance, Channel morphology, Discharge (Water), Sediment load, Sediment discharge.
Identifiers: Braided channels.

Based on the considerations of bank erosion and sediment transport, it is shown that in an aggrading channel, the shear stress can actually decrease with time. If there is no sediment supply from upstream, the channel may attain stability with no transport taking place in it. However, if there is sediment supply at the upstream end, the channel may widen so much and the depth may become so shallow that the flow cannot take place in a single channel, thus developing a tendency to braid. This can be a possible cause for the formation of a braided channel (or river). This hypothesis was tested and verified in a small laboratory channel. (Knapp-USGS)
W71-01781

SIMULATION OF RIVER BED VARIATION IN MOUNTAINOUS BASIN,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01782

ON THE GEOMETRICAL CHARACTERISTICS OF SAND WAVES,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 08B.
W71-01783

CHANGES OF TOP-SET-BED IN A SILTED RESERVOIR,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
Shohei Adachi, and Tatsuaki Nakatoh.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 269-272, 1969. 4 p, 5 fig.

Descriptors: *Reservoir silting, *Sedimentation, *Sediment transport, Theoretical analysis, Equations, Streamflow, Channel morphology, River beds, Sediment load, Particle size, Flow rates, Diffusion.
Identifiers: *Top-set-bed, *Japan.

A simple equation has been derived for river bed variation by neglecting the rate of changes of flow in time and space. The diffusion coefficient value may be understood as an index of dominant discharge for the river. The method is found to be a useful tool for determination of the top-set-bed in natural rivers in an extended period. (Woodard-USGS)

W71-01785

VARIATION OF ROUGHNESS DURING DEGRADATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01786

COMPUTATION OF DOMINANT DISCHARGE,
Gifu Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01787

PROBLEMS OF TWO-PHASE FLOW THEORY,
Novosibirsk State Univ. (USSR).
For primary bibliographic entry see Field 08B.
W71-01789

EFFECTIVE GRAIN-SIZE IN SEDIMENT TRANSPORT,
Florida Univ., Gainesville. Dept. of Civil Engineering.
B. A. Christensen.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 223-231, 1969. 9 p, 3 fig, 6 ref.

Descriptors: *Sediment transport, *Particle size, Tides, Shear stress, Tractive forces, Flow resistance, Turbulence, Sediments, Scour.
Identifiers: Effective grain-size.

Effective grain-size of a nonuniform natural sediment was defined and analytically determined for use in problems related to transport of sediments by tidal motion and moving water in general, with critical bed shear stresses. It is demonstrated that the same effective grain size may be used in all cases. A general formula was developed for its determination when the grain-size distribution curve is known. Evaluation is simplified by approximating the grain-size distribution curve by a series of straight lines. The influence of Hazen's uniformity coefficient on effective grain size is studied. Of particular interest is the fact that effective grain size never exceeds d50% and never is less than d10%. (Knapp-USGS)
W71-01791

DEEPENING THE APPROACH CHANNEL TO THE PORT OF COCHIN, INDIA,
Central Water and Power Research Station, Poona (India). Tidal Hydraulics Div.
For primary bibliographic entry see Field 08B.
W71-01792

SALINITY VARIATIONS, DENSITY CURRENTS, AND SILT TRANSPORT IN THE SAINT JOHN ESTUARY,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 02L.
W71-01794

HYDRAULIC AND SEDIMENTARY PROBLEMS IN TIDAL ESTUARIES,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 02L.
W71-01795

HYDROGRAPHIC CHANGES IN THE EDINBURGH CHANNELS, OUTER THAMES ESTUARY, U.K.,
Bedford Coll., London (England).
For primary bibliographic entry see Field 02L.
W71-01796

SALINITY EFFECTS ON ESTUARINE HYDRAULICS AND SEDIMENTATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Div.
For primary bibliographic entry see Field 02L.
W71-01813

THE MECHANICS OF SUSPENDED SEDIMENT DUE TO WAVE ACTION,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
Masataro Hattori.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 399-406, 1969. 8 p, 6 fig, 1 photo, 2 tab, 10 ref.

Descriptors: *Suspended load, *Standing waves, Waves (Water), Sediment transport, Turbulence, Turbulent flow, Diffusivity, Diffusion, Model studies, Hydraulic models.
Identifiers: Wave flumes.

A theory is presented for the distribution pattern of sediment concentration due to standing waves. The theoretical development introduces a delay distance between the sediment concentration and the water particle velocity, and assumes that the coefficient of diffusion is constant. A fairly good agreement is shown in comparison between the theory and experiments with respect to horizontal and vertical distributions of sediment concentration. The experiment was made in a two dimensional wave flume. Sediment concentration was measured with a instrument by which numbers of sediment particles in supsension were counted. (Knapp-USGS)
W71-01814

SEDIMENTATION PROCESSES AS PART OF HYDROLOGY,
Arizona Univ., Tucson. Dept. of Civil Engineering.
Emmett M. Lautsen.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 737-743, published by Univ of Illinois, 1969. 7 p 1 append.

Descriptors: *International Hydrological Decade, Conferences, *Education, *Sedimentation, *Sediment transport, Research and development, Water resources development, Hydrology, Hydraulics, Planning, Projects, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research.

Education in sedimentation for professional hydrologists is reviewed and suggestions are made for its improvement. The fundamental processes of sedimentation which the student must first understand as well as they are known are: under what conditions sediment particles begin to be moved by flowing water; how, and how much, bed load will be moved along by the flowing stream; how the bed material becomes suspended in the flow; how the sediment particles will be distributed throughout the suspension; what the bed form will be; and under what conditions the sediment particles will stop moving. Secondly, the student should start to get some appreciation for how he will have to apply his understanding of the fundamental sedimentation processes to real situations in which a prediction must be made as to what will happen under certain circumstances. Another reason sedimentation should be included in hydrology is that the stream and its valley are the consequence of the past history of the sedimentation processes. Thus to understand stream behavior, it is advantageous to understand why the stream is what it is. (Knapp-USGS)
W71-01828

GEOMORPHOLOGY,
Illinois Univ., Urbana. Dept. of Mining, Metallurgy and Petroleum Engineering.
Adrian E. Scheidegger.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 777-786, published by Univ of Illinois, 1969. 10 p, 1 fig, 12 ref. NSF Grant No GK-1186.

Descriptors: *International Hydrological Decade, *Conferences, *Geomorphology, *Stochastic processes, Erosion, Sedimentation, Water resources development, Forecasting, Hydrology, Hydraulics, Topography, Open channel flow, Alluvial channels, Drainage patterns (Geologic), Statistical models, Computers, Instrumentation.
Identifiers: *Water resources research.

The roles of geomorphology in hydrology and in the education of hydrologists are reviewed. Geomorphology is the science of the development of landscapes. Most of the appearance of a landscape is due to the action of water. The deterministic approach is not very practicable. There are too many individual soil particles and complex processes which have to be kept track of to accomplish present scientific means. The first steps in the statistical treatment of land-forming processes were taken by Leopold and Langbein, who noted an analogy between certain features of landscape development and thermodynamic principles, notably an analogy with the concept of entropy. The general idea of treating landscape development as a stochastic process can be applied to the theory of river meanders and the theory of drainage basin development. (Knapp-USGS)
W71-01830

SEAMAP DEEP-SEA CHANNEL,
Pacific Oceanographic Lab., Seattle, Wash.
For primary bibliographic entry see Field 07C.
W71-01919

EXPERIMENTAL STUDIES OF FLOWS WITH HIGH SOLID PARTICLE CONCENTRATIONS,
For primary bibliographic entry see Field 08B.
W71-01920

SUSPENDED LOAD TRANSPORT IN SWISS RIVERS (FRENCH),
Daniel Bonnard, and Jacques Bruschin.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 91-109, 1969. 19 p, 10 fig.

Descriptors: *Sediment transport, *Sediment load, *Rivers, *Sediment discharge, *Suspension, Foreign projects, Running waters, Sediments, Particle size, Sampling.
Identifiers: *Swiss Rivers, *Minimum sampling frequencies.

Suspended-sediment concentration measurements were made in Swiss Rivers to produce a basis for rules to be applied in selecting sampling points or verticals in order to get a reliable determination of suspended-sediment discharge from a limited number of samples. It was found that suspended-sediment load and size, water discharge, and water temperature vary in a somewhat parallel manner as well during the daily cycles as during floods. Graphs relating the results of the basic data determinations and suggestions for sampling time-tables are presented. (Woodard-USGS)
W71-01921

MECHANICS OF TURBULENT FLOW IN SEDIMENT-LADEN STREAMS,
Universidad Central de Venezuela, Caracas. Dept of Engineering.
Anatol Zagustin, and Konstantin Zagustin.

rench resume. In: Proceedings 13th Congress of ie International Association for Hydraulic esearch, Kyoto, Japan, August 31-September 5, 969, Vol 2 (Subject B), Science Council of Japan, yoto, p 317-324, 1969. 8 p, 2 fig, 8 ref.

escriptors: *Sediment transport, *Turbulent flow, Mathematical studies, *Sediment distribution, Streams, Channel morphology, Flow rates, Parti- le size, Flow resistance, Foreign projects.
lentifiers: *Theoretical curve, *Caracas Venezuela).

theoretical curve for relating distribution of ispended sediment in turbulent flowing streams is resented. The presence of solid particles with a iven fall velocity affects the momentum equation nd produces an additional term in the expression or the turbulent shear, which is proportional to the ediment concentration. The equation for the tur- ulent shear is used to study the effect of sediment n the mean slope of the velocity distribution in the tream, and an analytical expression is obtained as function of a non-dimensional parameter which ontains the basic flow variables. The curve is com- ared with different experimental data for labora- ory flumes and rivers with satisfactory results. (Woodard-USGS)
W71-01923

TRANSPORT CAPACITY OF TURBULENT TWO-PHASE FLOW,
nstitut za Vodoprivredu Jaroslav Cerni, Belgrade Yugoslavia).
tevan Bruk, and Vera Miloradov.
French resume. In: Proceedings 13th Congress of he International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 357-369, 1969. 13 p, 4 fig, 1 tab, 13 ref.

Descriptors: *Sediment transport, *Sediment distribution, *Stratified flow, *Turbulent flow, *Mathematical studies, Streams, Channel morphology, Flow rates, Particle size, Flow resistance, Foreign projects.
Identifiers: Belgrade (Yugoslavia).

Mathematical expressions relating transport of suspended solid particles in turbulent flow are described. The transport capacity coefficient is identified as a Richardson number, representing a parameter of dynamical similarity of flow. The structure of this coefficient is analyzed and related to field investigations conducted on a sediment-carrying river. Correlations were established between the transport of suspended load and flow characteristics. (Woodard-USGS)
W71-01925

REPRESENTATION OF NON-GRANULAR BOUNDARIES IN HYDRAULIC MODELS,
Department of State Hydraulic Works, Ankara (Turkey). Research Section.
For primary bibliographic entry see Field 08B.
W71-01927

POLYPHASE CURRENTS WITH NONUNIFORM SEDIMENTS AND THE PHYSICS OF RIVER FLOW,
I. Egiazaroff.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 165-175, 1969. 11 p, 3 fig, 22 ref.

Descriptors: *Sediment transport, *Rivers, *Erosion, *Streamflow, *Currents (Water), Flow rates, Channel morphology, Topography, Watersheds (Basins), Particle size, Floods, Sediment distributions, Equations, Foreign projects.
Identifiers: *USSR.

Characteristics of sediment transport under polyphase conditions of watershed topography, channel morphology, streamflow and particle size are interpreted with equations and graphs from data available for 58 rivers in the USSR. Motion of turbulent river flow is divided into two classes--torrential sediment flow, when all sediment sizes are in motion and channel surfaces are eroded; and nontorrential sediment flow, when the channel surface is built up and larger particles are at rest and sheltering smaller particles. Suspended load and increasing turbidity are illustrated by Shagap River (83 sq km in Armenian SSR) where a flow of only 1.9 cms carries a suspended load of 277 grams per liter. Rivers of the Amu-Daria Watershed in middle Asia, which carry large quantities of fine sand and mud, show relationships of mud load, mean velocity, depth, and sediment free fall velocity. (Lang-USGS)
W71-01929

THE EFFECT OF BED FORMS ON THE HYDRAULIC RESISTANCE,
Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering and Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01931

DISTRIBUTION OF SUSPENDED MATTER AND SIMILARITY CRITERIA IN SETTLING BASINS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
For primary bibliographic entry see Field 08B.
W71-01937

THE TURBULENCE WITH FINE PARTICLES IN UPWARD FLOW,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
Yoichi Awaya, and Tetsuya Kusuda.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 203-210, 1969. 8 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Sedimentation, *Turbulence, *Flocculation, *Fine aggregates, *Anemometers, Gravity, Flow, Velocity, Model studies, Mathematics, Equations, Sediments, Particle size, Specific gravity, Foreign projects.
Identifiers: *Upward flow, *Japan.

The energy spectrum related to turbulence resulting from the settling of particles is measured with a hot wire anemometer developed in the authors' laboratory. It has been clarified that the acceleration of gravity and drag force are predominant and the value of inertia term is negligible in the turbulence resulting from the settling of particles. Many errors resulted by applying the hot wire anemometry to the measurement of turbulence with rigid particles. Related equations, graphs, and tables of data are included. Many theoretical and experimental studies have been reported concerning turbulence resulting from friction in the bed with suspended particles. This investigation determines that the theoretical analysis of turbulent flow with suspended particles can be classed as polyphase flow. (Woodard-USGS)
W71-01938

ON THE MECHANICS OF SALTATION OF A SPHERICAL SAND PARTICLE IN A TURBULENT STREAM,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yoshito Tsuchiya.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 191-198, 1969. 8 p, 5 fig, 1 photo, 9 ref.

Descriptors: *Sediment transport, *Saltation, *Turbulent flow, *Sands, *Theoretical analysis, Particle size, Particle shape, Specific gravity, Dynamics, Streams, Flow rates, Velocity, Turbulence, Equations, Channel morphology, Foreign projects.
Identifiers: *Sand particle, Sliding motion, Rolling motion, Angular motion, Kyoto (Japan).

In order to establish the mechanics of sediment transport, a theory about the saltation of a single sand particle from the beginning of movement in a turbulent stream is described, based on the mechanism of rolling motion and collision of the rolling sand particle with a bed sand particle. It was concluded that the theoretical relationships of the rolling velocity, the rolling distance and distributions, and the characteristics of the saltation height and distributions are in fairly good agreement with the experimental values. (Woodard-USGS)
W71-01939

RESEARCH OF THE SOLID-LIQUID FLOWS WITH HIGH CONSISTENCE,
Akademiya Nauk URSR, Kiev.
For primary bibliographic entry see Field 08B.
W71-01952

THE STRUCTURE OF NATURAL TURBULENT SEDIMENT-LOADED STREAMFLOW,
Gidrometeorologicheskii Institut, Odessa (USSR).
D. I. Grinvald.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 251-259, 1969. 9 p, 3 fig, 6 ref.

Descriptors: *Sediment transport, *Turbulence, *Natural flow, *Rheology, *Statistical methods, Channel morphology, Mathematics, Equations, Computers, Suspended load, Sediment load, Particle size, Flow rates, Velocity, Sediment distribution, Foreign projects.
Identifiers: *USSR.

Statistical characteristics of suspended load concentration in natural turbulent streamflow are presented. Data are included on the energy spectrum of streamflow turbulence, the dissipation of turbulent energy and the turbulence scale. Within a certain frequency sector an 'inertia interval' takes place. Autocorrelative, structural and spectral functions of the concentration parameter were computed and agree with similar velocity functions. A coincidence of the spectral functions of velocity and concentration is evident for the high-frequency sector of the spectrum. In accordance with the diffusion conception, the actual distribution of suspended particles approaches the theoretical one. (Woodard-USGS)
W71-01955

LAMINAR FLOW OF SAND-WATER SUSPENSIONS,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
K. Subramanya.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 221-231, 1969. 11 p, 7 fig, 11 ref.

Descriptors: *Laminar flow, *Sediment transport, *Sands, *Water, *Suspension, Theoretical analysis, Mathematics, Equations, Channel flow, Flow rates, Rheology, Gravity, Sediment distribution, Streambeds, Particle size, Suspended load, Foreign projects.
Identifiers: *India.

The rheological behavior in laminar flow of sand-water suspension was investigated by using a capillary viscometer. The suspension was found to behave as a non-Newtonian dilatant fluid over the

range of shear rates tested. Bagnold's concept of grain shear stress and linear concentration are used to analyze the data. A critical concentration at which there is an abrupt change in characteristics of suspension is noticed at concentrations between 0.30 and 0.35 microns. (Bagnold showed by momentum analysis that between successive layers of a suspension of spheres there exists a shear stress which is in addition to any shear stress necessary for motion of fluid only.) Similar results to Bagnold's experimentally derived curve indicate that the dimensionless terms used are meaningful. (Woodard-USGS)
W71-01956

THE CHARACTERISTICS OF FLOW WITH WASH LOAD,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
Hideo Kikkawa, and Shoji Fukuoka.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 233-240, 1969. 8 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Sediment transport, *Sediment load, *Flow characteristics, *Model studies, *Turbulent flow, Alluvial channels, Scour, Flow rates, Sediments, Bed load, Suspended load, Movement, Particle size, Running waters, Sedimentation rates, Settling velocity, Specific gravity, Flumes, Foreign projects.
Identifiers: *Wash load.

When suspended bed-material sediment is transported in a given hydraulic condition, it is important to understand what changes take place in the water and sediment flow due to the wash load added to the flow. The following conclusions were made from model studies at Tokyo Institute of Technology: (1) The behavior of wash load is almost the same as the behavior of suspended load; (2) an equation expressing the distribution of sediment concentration was derived and was verified to be reasonable by experimental data; (3) the wash load affects the concentration of bed material load and the transport rate; and (4) in some cases, the presence of wash load changes the feature of bed configuration in alluvial streams and thereby the flow resistance and the rate of sediment transport are affected considerably. Related graphs, equations, and tables of data are included. (Woodard-USGS)
W71-01957

THEORETICAL DESCRIPTION OF FREE SURFACE TWO-PHASE FLOW OVER A WAVY BED,
Universidad Central de Venezuela, Caracas. Hydraulics Lab.
For primary bibliographic entry see Field 08B.
W71-01962

EROSION CONTROL ON HIGHWAY RIGHTS-OF-WAY IN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
A. E. Spooner, and C. L. Murdoch.
Available from NTIS as PB-194 017, $3.00 in paper copy, $0.95 in microfiche. Highway Research Project No 15 Final Report, June 1970. 156 p, 82 tab, 7 fig.

Descriptors:
Identifiers: *Highways, *Erosion control, Vegetation, Grasses, Herbicides, Limestone, Fertilizers, Moisture, Mulches, Arsenic organic acids, Arsenates, Soil, Maintenance, Costs, Effectiveness, Arkansas, *DSMA herbicide, *Highway rights of way, Methane arsonic acid, Acetic acid/2-4-dichlorophenoxy.

Materials and methods for establishment, maintenance and control of vegetation were investigated. Laboratory and field experiments indicate that a straw and/or wood celluose fiber mulch is essential for establishment of vegetation. Prevention of erosion and maintenance of necessary moisture relationship are the principal factors. The need for adequate fertility following seeding and for maintaining nutrient levels were investigated. Original applications of 800 lbs/acre of 10-20-10 with 2 to 3 year repeat applications of 500-700 lbs/acre are recommended. Two to four tons of agricultural limestone or dicalcium silicate should be applied initially. Tall fescue, common bermudagrass, weeping lovegrass and bahiagrass are the most adaptable grass species for highway use in Arkansas. Effective vegetation control with 2,4D can eliminate weeds and reduce or eliminate expensive mowing operations on some areas. Greenhouse and field experiments with maleic hydrazide as a growth retardant proved effective. Johnsongrass can be effectively controlled with 2 to 3 applications of organic arsenical herbicided--DSMA (Disodium methylarsonate) MSMA (methanerarsonic acid)--at 2 to 4 lbs/acre. A method was developed to determine the mode of action of organic arsenical herbicides on Johnsongrass.
W71-02051

2K. Chemical Processes

EOLIAN SEDIMENT INFLUENCE ON PEDOGENESIS DURING THE QUATERNARY,
Wisconsin Univ., Madison. Department of Soil Science; Chicago Univ., Ill.; and California Univ., Riverside. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02G.
W71-01709

THERMODYNAMIC EQUILIBRIUM CONSTANTS OF SODIUM-CALCIUM EXCHANGE IN SOME ISRAEL SOILS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 02G.
W71-01717

TRITIUM HYDROLOGY OF THE TALLAHASSEE, FLORIDA AREA WITH ANALYSIS BY LIQUID SCINTILLATION COUNTING WITHOUT ISOTROPIC ENRICHMENT,
Florida State Univ., Tallahassee. Dept. of Geology.
Edward I. Wallick.
M.S. Thesis, Florida State University, December 1969. 110 p, 18 fig, 11 tab, 30 ref. OWRR Project A-011-FLA (6).

Descriptors: *Water chemistry, *Tritium, *Tracking techniques, *Florida, Radioactive dating, Mixing, Water sources, Groundwater, Recharge, Discharge (Water), Groundwater movement, Aquifers, Springs, Tracers, Hydrogeology, Artesian wells.
Identifiers: Tallahassee (Fla).

An inexpensive and simple method was developed for the analysis of low-level tritium in natural waters. The hydrogen of the water sample is associated with carbon to form acetylene during the hydrolysis of calcium carbide. The lower detection limit of the system is 8 Tritium Units, and activities of 50 Tritium Units may be detected within a statistical error of 10 percent. The method is suitable for measurement of tritium in rain, groundwater, and ocean water. In the western half of Leon County and eastern Gadsden County, Florida, the waters are pre-bomb, that is, older than 1952, and show little evidence of mixture with younger waters. Little, if any, lateral dispersion of waters occurs across the boundary zone. Flow is entirely from north to south along the eastern side of the boundary according to the peizometric surface. Mixing coefficients at Wakulla Springs during the dry season were estimated at 65 percent deep artesian water and 35 percent shallow ground and surface runoff water. (Knapp-USGS)
W71-01777

RESEARCH ON THE MARINE FOOD CHAIN. PROGRESS REPORT, JULY 1968-JUNE 1969. VOLUME 1. CHEMISTRY AND MICROBIOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 05A.
W71-01885

THE APPLICATION OF PHASE SELECTIVE ALTERNATING CURRENT POLAROGRAPHY TO THE ANALYSIS OF HEAVY METALS IN WATER,
Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 05A.
W71-01895

SPATIAL SPECTRA OF OCEAN SURFACE TEMPERATURE,
National Oceanic and Atmospheric Administration, Miami, Fla. Sea-Air Interaction Lab.
William McLeish.
Sponsored by Office of Naval Research. Journal of Geophysical Research, Vol 75, No 33, p 6872-6877, November 20, 1970. 6 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Surface waters, *Oceans, *Temperature, Spectrometers, Wavelengths, Atmosphere, Density, Water circulation.
Identifiers: *Spatial spectra, *Ocean-Atmosphere temperature relationship.

One-dimensional variance spectra of radiometric ocean surface temperature are similar at small wave numbers to horizontal spectra within the upper ocean. The variance densities in both surface water and upper ocean water decrease continuously with increasing wave numbers. However, at great wave numbers the spectra within the water continue to decrease, but the surface spectra often become nearly constant. The additional variance density there is attributed to alteration of the surface temperature by patches of compacted organic films. This compaction is produced by convergences in the turbulence within the water. Thus small-scale temperature patterns on the ocean surface often represent only a superficial consequence of the water circulation rather than bulk temperature variations. (Woodard-USGS)
W71-01907

RAPID ANALYTICAL METHODS FOR THE INVESTIGATION OF METALS AND INORGANIC RAW MATERIALS. XII. DETERMINATION OF TRACE AMOUNTS OF BERYLLIUM IN MINERAL WATERS AND MINERALS,
California Univ., Livermore. Lawrence Radiation Lab.
Z. Sulcek, J. Dolezal, and J. Michal.
Available from NTIS as UCRL-TRANS-10443, $3.00 in paper copy, $0.95 in microfiche. January 70. 19 p.
Identifiers: *Beryllium, Chemical analysis, *Minerals, Beryllium, Ethylenedinitrilo tetraacetates, Chelate compounds, Czechoslovakia, *Morin, Flavones, *Fluorometric analysis.

A study was made of the sorption of beryllium onto silica gel from weakly acid, neutral, and weakly alkaline solutions. The addition of Complexon (EDTA) and tartrate makes the separation to a large extent selective, and with subsequent elution of the beryllium by hydrochloric acid it enables a straightforward determination of beryllium by the fluorometric technique using morin. The technique has been used for the determination of trace amounts of beryllium in mineral waters and minerals.
W71-01990

2L. Estuaries

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
For primary bibliographic entry see Field 05G.
W71-01659

QUANITATIVE DISTRIBUTION OF BENTHIC MACROFAUNA IN THE BLACK SEA,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-01683

BARRIER ISLANDS OF THE NORTHERN GULF OF MEXICO COAST: SEDIMENT SOURCE AND DEVELOPMENT,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Hyuck J. Kwon.
Available from NTIS as AD-704 541, $3.00 in paper copy, $0.95 in microfiche. Technical Report No. 75, December 31, 1969. 51 p, 32 fig, 159 ref, 1 tab. ONR Contracts Nonr-1575 (03), Nonr-1575 (00).
Identifiers: *Seacoast, Mexico Gulf, *Islands, Sedimentation, Sources, Transport properties, Sand, Deposits, Estuaries, Geologic age determination, Deltas, Ocean waves, Tides, Florida, Littoral drift, Landforms, Barriers.

The evolution of barrier islands along the northern Gulf of Mexico coast is directly related to source of sediments and littoral processes. Johnson formulated his hypothesis on barrier island formation in 1919, and his theory prevailed for several decades. Johnson's theory resulted from consideration of only two dimensions normal to the coastline; a third, longshore drift, was not regarded as critical for the initiation of barrier island development. In this study, which is confined to the northern Gulf coast, major sources of sediment supply and transportation patterns of barrier forming sand were examined, along with results of recent oceanographic investigations in the Gulf of Mexico. This study is based on a comprehensive survey of the literature, maps, and marine charts, which were correlated with field observations. To obtain a perspective, only gross forms and processes of barrier development were considered. Evidence indicates that Santa Rosa, island, Mississippi Sound, and Bolivar Peninsula barriers developed downdrift of sediment-supplying coast of Quaternary age. These barriers evolved with the Recent rise of sea level to its present stand. Apalachicola barriers formed on the flanks of the Pleistocene deltaic plain. Coasts such as the stretch between Destin and Panama City, Florida, and the zero-energy coast of Florida do not have barrier islands. In these cases the modern shoreline is abutted against Pleistocene deposits which are the local source of sediments.
W71-01684

TEMPERATURE, DISSOLVED OXYGEN, TOTAL ALKALINITY, AND BIOCHEMICAL OXYGEN DEMAND IN THE COLUMBIA RIVER ESTUARY, 1966-67,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
Carl W. Sims, and Carl J. Cederholm.
Available from NTIS as PB-189 503, $3.00 in paper copy, $0.95 in microfiche. Fish and Wildlife Service Data Report 43, January 1970. 32 p, 18 tab, 3 ref.
Identifiers: *Estuaries, Ecology, *Water pollution, Estuaries, Oxygen, pH, Bases (Chemistry), Temperature, Industries, Fishes, Columbia River estuary, Biochemical oxygen demand, Fisheries, Limnology.

Temperature, dissolved oxygen, total alkalinity, and biochemical oxygen demand collected at 19 locations in the Columbia River estuary are presented as a reference for researchers in fisheries or in water quality.
W71-01689

BENTHIC BIOMASS AND SURFACE PRODUCTIVITY,
Woods Hole Oceanographic Institution, Mass.
Gilbert T. Rowe.
Available from NTIS as NYO 3862-24, $3.00 in paper copy, $0.95 in microfiche. Contribution No. 2420, 1969. 22 p. Contract AT (30-1)-3862.
Identifiers: *Marine biology, *Ocean bottom, Aquatic animals, Plants (Botany), Surface properties, *Benthos, *Biomass.

Benthic samples from the north temperate Atlantic, the Gulf of Mexico, the Atlantic off Brazil, and the Pacific off Peru provided data for a comparison of animal densities and biomass under varying ecological conditions. The average biomass and the different rates of decrease in life with depth in different regions can be used to infer the magnitude of effects of surface production on the bottom fauna. These averages are significantly higher in regions of high primary productivity (New England and Peru) than where productivity is low (Bermuda, Brazil, and the Gulf of Mexico). The regression coefficients or rates of decrease in animal density were greatest where surface prductivity varied markedly in an offshore direction (Woods Hole and Brazil). Where productivity varied to a lesser degree (Peru, Gulf of Mexico, and Bermuda), the rates of decrease were reduced. These regressions suggest that while depth exerts the most stringent effects, surface productivity ranks second in controlling benthic biomass. In the upwelling region off Peru, the hydrography and associated high productivity have caused marked oxygen depletion in sediments and bottom water. The result is a numerically dense fauna of low biomass and diversity where the oxygen minmum zone impinges on the bottom, and a diverse community of high biomass in deeper water offshore. In this situation, the effects of productivity on benthic biomass are more pronounced than depth, and rather than ameliorating benthic production, have inhibited it.
W71-01697

BOTTOM TOPOGRAPHY AND SEDIMENT TEXTURE NEAR THE COLUMBIA RIVER MOUTH,
Washington Univ., Seattle. Dept. of Oceanography.
Dean A. McManus.
Available from NTIS as PB-193 298, $3.00 in paper copy, $0.95 in microfiche. 1970. 24 p, 2 tab, 8 ref. AEC AT (45-1)-1725.
Identifiers: *Continental shelves, Ocean bottom topography,*Rivers, Sedimentation, Deposits, Silt, Sand, Seacoast, Erosion, Beaches, Harbors, Pacific Ocean, Columbia River, Willapa Canyon, Willapa Bay, Topographic relief, Continental slopes, Submarine canyons.

The shelf topography and sediments near the mouth of the Columbia River can be grouped into six units: (1) rough topography of relict sediments, (2) outer shelf silty sand, (3) inner shelf sand wedge, (4) nearshore sand, (5) Columbia River silt deposit, and (6) shelf-break sand. Each unit is characterized by certain aspects of the topographic relief or gradient and by the distribution of sediment texture.
W71-01698

MACROPHYTES OF THE SAKHALIN SEA COAST,
Naval Oceanographic Office, Washington, D.C.
V. B. Vozzhinskaya.
Available from NTIS as AD-704 668, $3.00 in paper copy, $0.95 in microfiche. Trans. from Trudy Inst. Okeanologii, Vol 69, p 330-441, 1964. Naval Oceanographic office, Translation 462, 1969. 139 p.
Identifiers: *Algae, *Ecology, Distribution, Classification, Marine biology, Ocean bottom sampling, Geography, USSR, Translations, Sakhalan Sea.

The marine bottom flora of Sakhalin was studied. One hundred and sixty-five (165) species of the algae flora were observed; forty-seven (47) species are new to Sakhalin, and 5 species are new to science. Altogether there are 286 species of algae, 50 species belong to Chlorophyccac, 90 to Phacophyccac, 146 to Rhodophyccac orders. Phytogeographically, the algae of Sakhalin are of different origin. A comparison of the algal flora of Sakhalin with other regions of the North Pacific shows that the algal flora of Sakhalin constitutes a phytogeographical boundary between the algal flora of the warm-water and cold-water regions of the North Pacific. The closest relationship exists between the algal flora of Sakhalin and Hokkaido. The vertical and horizontal distribution is diverse in supralitoral, litoral, upper sublitoral zone. This distribution depends on the bottom structure, the wave action, the height and mode of the tide. Only 75 species of all Sakhalin algae are abundantly distributed. The distribution of biomasses varies from area to area. A number of algae can be used for food or for other puroposes. Data on the distribution and crop of algae within Sakhalin are given in this study.
W71-01699

COASTAL/ESTUARINE POLLUTION, AN ANNOTATED BIBLIOGRAPHY,
Ocean Engineering Information Service, La Jolla, Calif.
For primary bibliographic entry see Field 05C.
W71-01788

PROGRESSIVE SALINITY INTRUSION DURING THE DRY SEASON IN THE HOOGHLY ESTUARY, INDIA,
Central Water and Power Research Station, Poona (India).
C. V. Gole, and V. S. Thakar.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 275-282, 1969. 8 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Streamflow, Mixing, Tidal effects, Tides, Discharge (Water), Water supply, Water quality, Mathematical models, Model studies, Convection, Diffusion, Dispersion, Salinity, Saline water systems.
Identifiers: Hooghly estuary (India).

Freshwater flows into the Hooghly estuary are confined to the four months from July to October. The discharge reaches maximum values of the order of 3,000 cu m/s. There is practically no upland flow during the remaining period of the year. The river salinities, which are almost nil during and just after a freshet season, rise steadily through the dry season owing to the tidal action. The dry season salinity intrusion seriously affects the supply of drinking water to the city of Calcutta. Analysis of the intrusion phenomenon over a tidal cycle yields a distribution which is the same from one tidal cycle to another. An analytical model is developed from the basic convective diffusion equation to describe the mean space-time salinity distributions over long periods of time in the Hooghly. (Knapp-USGS)
W71-01793

SALINITY VARIATIONS, DENSITY CURRENTS, AND SILT TRANSPORT IN THE SAINT JOHN ESTUARY,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
H. A. Neu.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 241-248, 1969. 8 p, 8 fig, 5 ref.

Descriptors: *Sediment transport, *Saline water intrusion, *Estuaries, Silting, Sedimentation, Saline water-freshwater interfaces, Mixing, Flow, Tides,

Tidal effects, Bores, Stratified flow, Unsteady flow, Density currents.
Identifiers: St. John Estuary (Canada), Bay of Fundy.

Most of the mixing between fresh and salt water in the Saint John River of Eastern Canada is confined to a short reach near the mouth of the estuary due to a natural constriction in the river channel which acts as a salinity barrier and as an impediment to tide propagation. The constriction causes cyclic outflows and inflows of fresh and salt water, creating a highly variable density regime in which the flow is both unsteady in time and non-uniform spatially. During a tide cycle, there are two principal flow systems, a two-layer system having opposite moving currents and large salinity gradients and a single layer unidirectional system with small salinity gradients. Good agreement was obtained between theory and observations with regard to the interfacial Froude number, the freshet ebb tide discharge during which the salt water is washed away from the mouth of the river, the length of the saline wedge, the critical interfacial velocity and the rate of entrainment from the undiluted saline lower layer into the upper layer. Bed currents transport some silt back into the mouth of the river from where it is washed over the 'Reversing Falls' into the lake-like river system where part of it forms an inverse delta. (Knapp-USGS)
W71-01794

HYDRAULIC AND SEDIMENTARY PROBLEMS IN TIDAL ESTUARIES,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
Fernando M. Adecasis.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 249-256, 1969. 8 p, 5 fig, 4 ref.

Descriptors: *Estuaries, *Sediment transport, *Tides, *Tidal effects, Sedimentation, Channel morphology, Currents (Water), Bed load, Suspended load, Sand bars, Provenance, Hydraulics, Reviews.
Identifiers: Hydraulics of estuaries.

The hydraulic and sedimentary factors influencing shape and depth of the inner and outer channels in tidal estuaries are reviewed. The major influence of the ebb currents, is based on the characteristics of tidal channel morphology and on the conincidence of stronger velocities with low water levels. The hydrodynamic phenomena in the outside channels and the influence of the characteristics of the sediments and of the ocean currents, on the shape, depth and stability of the outside channels are discussed. Special attention is given to the difference in behavior of the outside channels when the outside bars are fed with bed-load (sand) or suspended-load (silt or clay). (Knapp-USGS)
W71-01795

HYDROGRAPHIC CHANGES IN THE EDINBURGH CHANNELS, OUTER THAMES ESTUARY, U.K.,
Bedford Coll., London (England).
I. P. Jolliffe.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 257-274, 1969. 18 p, 13 fig, 6 ref.

Descriptors: *Estuaries, *Silting, *Sedimentation, *Mapping, Currents (Water), Tides, Tidal effects, Bed load, Channel morphology, Navigation, Scour, Erosion, Deposition (Sediments).
Identifiers: Thames Estuary (England).

A detailed chart analysis shows morphological changes in the outer Thames estuary by means of various cartographic techniques. The whole of the estuary bed is undergoing changes, but the broad pattern of long banks and intervening deeps has remained more or less the same for a period of over 100 years. The banks change principally by longitudinal extension. More significantly, major, rapid and unpredictable changes occur in the transverse swatchways and on the sills between the ebb and flood channels. The ebb-flood channels, which tend to be mutually evasive, characterize much of the central and northern parts of the outer estuary and are developed on a smaller scale within the Edinburgh Channels system. (Knapp-USGS)
W71-01796

STUDY OF THE INFLUENCE OF A DAM, BUILT IN A TIDAL ESTUARY, ON ITS TIDAL CHARACTERISTICS,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 08B.
W71-01797

MATHEMATICAL SIMULATION OF TWO-DIMENSIONAL HORIZONTAL CONVECTIVE-DISPERSION IN WELL-MIXED ESTUARIES,
Texas Univ., Austin. Dept. of Civil Engineering.
Frank D. Masch, and Nilakantan J. Shankar.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 293-301, 1969. 9 p, 5 fig, 2 ref.

Descriptors: *Estuaries, *Convection, *Dispersion, *Mixing, *Texas, *Mathematical models, Model studies, Computer models, Sediment transport, Currents (Water), Water circulation, Salinity, Saline water systems.
Identifiers: Well mixed estuaries, Galveston Bay.

A finite difference transport model was developed for solving the convective-dispersion equation in two-dimensional well-mixed estuaries. The transport model is structured in such a way that it accepts as basic input net velocities and depths from a two-dimensional hydrodynamic model. The model describes transport by convection and dispersion over long periods of time for constant hydrologic inputs. The adaptability of the finite difference model to real estuarine systems is demonstrated by its application to the Galveston Bay complex, an estuary typical of the bays along the Gulf Coast of the United States. The transport model was also used to evaluate the effect of enlarging an existing pass in the bay on the salinity of the system. (Knapp-USGS)
W71-01798

FLUME STUDY ON SALINITY INTRUSION IN ESTUARIES,
Waterloopkindig Laboratorium, Delft (Netherlands).
A. J. van Rees, and B. P. Rigter.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 303-310, 1969. 8 p, 3 fig.

Descriptors: *Estuaries, *Saline water intrusion, *Hydraulic models, *Mixing, Tides, Currents (Water), Salinity, Saline water systems, Turbulent flow, Turbulence, Mass transfer, Mathematical models, Model studies, Flumes, Laboratory tests, Hydraulic similitude, Reviews.
Identifiers: Netherlands, Delft, Delft Hydraulics Laboratory.

An outline is given of a current research program being carried out by the Delft Hydraulics Laboratory, on salinity intrusion in estuaries. The study uses a flume, which essentially is a schematized river of rectangular cross-section issuing into a basin equipped for the generation of tides and control of source salinity. One purpose of the study is to find optimum reproduction of prototype conditions in estuary models and to obtain an analytical description of the estuarine streampattern under varying conditions. In this connection the flume experiments are intended to reveal details about the turbulent exchange of momentum and mass, required for a numerical treatment of the problem. (Knapp-USGS)
W71-01799

DAMPED COOSCILLATING TIDE WITH NEGATIVE REFLECTION AT THE END OF THE ESTUARY,
Ecole Polytechnique, Montreal (Quebec).
Hans-Werner Partenscky, and Jean-Claude Warmoes.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 363-370, 1969. 8 p, 4 fig.

Descriptors: *Mathematical models, *Fourier analysis, *Tidal effects, *Tides, *Estuaries, St. Lawrence River, Water level fluctuations, Streamflow, Waves (Water), Surges, Fluid friction, Wavelengths, Numerical analysis.
Identifiers: Tidal velocities.

Harmonic analysis of damped cooscillating tides in an estuary was applied to cases where the incoming tidal wave undergoes a negative reflection at the upstream end of the estuary due to a sudden enlargement of the channel width. The basic equations for the tidal elevations, tidal discharges and velocities are derived for the general case of an estuary in which the surface width and mean water depth are functions of distance. Expressions are determined for the local time of high water at a given section relative to the head of the estuary, as well as for the variation in tidal wave length with distance. An overall damping coefficient is defined in which the effects of frictional energy dissipation and reflection of wave energy from the lateral boundaries are combined. The developed mathematical model was applied to the Estuary of the St. Lawrence River, Canada. The results were in good agreement with field measurements. (Knapp-USGS)
W71-01808

ON VERTICAL SALINITY DISPERSION INTO FRESH WATER OVER SALT WATER DUE TO TURBULENCE,
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
Isao Minami.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 381-387, 1969. 7 p, 3 fig, 4 ref.

Descriptors: *Mixing, *Turbulent flow, *Stratified flow, *Vorticies, *Eddies, Mass transfer, Dispersion, Diffusion, Density stratification, Saline water-freshwater interfaces.
Identifiers: Turbulon models.

Theoretical estimation of vertical salinity dispersion into fresh water from underlying salt water is treated from the standpoint of 'turbulon' of eddy dispersion. The characteristics of isotropic turbulence are found in turbulon motion in both fresh and salt water. In the vertical dispersion of salinity in stratified flow, the contribution of larger turbulons to vertical salinity dispersion is strongly depressed by the buoyancy effect; thus salinity dispersion is largely caused by the smaller turbulons. Analytical solutions for salinity distribution and dispersed salinity into fresh water layers from salt water are deduced from the results of application of the turbulon model as a conveyance of salinity. (Knapp-USGS)
W71-01810

MATHEMATICAL MODEL OF THE RECOVERY OF SALINITY STRATIFICATION IN THE UNSTEADY FLOW REGIME (FRENCH),
Electricite de France, Paris.
F. Boulot, and A. Daubert.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 353-362, 1969. 10 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Stratified flow, *Mathematical models, Density stratification, Unsteady flow, Streamflow, Numerical analysis, Model studies, Mixing, Salinity, Saline water systems, Saline water-freshwater interfaces.
Identifiers: Rhone Estuary (France).

A mathematical model was made of the intrusion of salinity in stratified layers (salt wedge). This model deals with unsteady flows of two fluids of slightly different densities with a free surface and an interface. The equations, assuming gradually varying flows, lead to a system of partial differential equations, which is solved numerically by the Lax-Weddroff explicit scheme. This computation program was used for the calculation of the slat wedge in the Grand Rhone, France. Comparisons of the results with in situ measurements show the position of the salt wedge and its movements under the effect of tide. Difficulties of calibration are mentioned and especially the impossibility of getting data for a stationary salt wedge. (Knapp-USGS)
W71-01812

SALINITY EFFECTS ON ESTUARINE HYDRAULICS AND SEDIMENTATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Div.
Henry B. Simmons, and Fred R. Brown.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 311-325, 1969. 15 p, 7 fig.

Descriptors: *Estuaries, *Saline water intrusion, *Mixing, Tidal effects, Current (Water), Water circulation, Sedimentation, Deltas, Mississippi River, Delaware river, Channel morphology, Discharge (Water), Tides, Streamflow, Sediment transport, Surveys, Reviews, Saline water-freshwater interfaces, Stratified flow, Density stratification.
Identifiers: Vicksburg (Miss.), U. S. Army Corps of Engineers, Waterways Experiment Station, Savannah River.

Waters of variable density in tidal estuaries result in marked differences in the magnitude, distribution, and duration of currents which in turn affect the shoaling characteristics. For purposes of this paper the degree of mixing has been separated into three broad categories of highly stratified, partly mixed, and well mixed. The most important characteristics of each category are illustrated by observations made in some of the larger estuaries of the United States, such as the Mississippi River, Savannah Harbor, and the Delaware River. Changes in the upland discharge, tidal prism, and physical configurations of estuaries will alter the degree of salt- and fresh-water mixing and affect the direction and degree of flow predominance and the location and amount of shoaling. The effect of changes in the upland discharge is of primary importance. (Knapp-USGS)
W71-01813

A CONDUCTIVITY BRIDGE FOR THE MEASUREMENT OF SALINITY OF SEA WATER,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 07B.
W71-01877

BIOENVIRONMENTAL AND RADIOLOGICAL SAFETY FEASIBILITY STUDIES ATLANTIC-PACIFIC INTEROCEANIC CANAL. FINAL REPORT, TERRESTRIAL ECOLOGY,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 05C.
W71-01883

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES: ATLANTIC-PACIFIC INTEROCEANIC CANAL. DARIEN FISH DIETARY,
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 05C.
W71-01884

RESEARCH ON THE MARINE FOOD CHAIN. PROGRESS REPORT, JULY 1968-JUNE 1969, VOLUME 1. CHEMISTRY AND MICROBIOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 05A.
W71-01885

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W71-01900

WATER RESOURCES INVENTORY OF CONNECTICUT - PART 4. SOUTHWESTERN COASTAL RIVER BASINS,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-01912

TIDAL RELATIONS ALONG THE INTRACOASTAL WATERWAY, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, Fla.
James J. Schneider.
Geological Survey Open-file Report 70006, June 1970. 17 p, 6 fig, 1 tab, 3 ref.

Descriptors: *Tidal waters, *Inland waterways, *Florida, Tides, Flow profiles, Water levels, Tidal effects, Atlantic Ocean.
Identifiers: *Tidal range, *Broward County (Fla.).

One of the most intensely developed urban areas in the Nation borders the Intracoastal Waterway in Broward County, Florida. An investigation was made to assist County officials in establishing the elevation of mean high water and tidal patterns along the waterway. The results of the investigation are based on records collected from five tide gages during the period March 1, 1968 through February 28, 1969. Along the waterway, mean high water was approximately 1.5 feet above mean sea level. The mean tidal range in the waterway at Hollywood was 0.6 foot less than the tidal range of the ocean at Miami Beach. The difference between mean half tide and mean water level was negligible at all stations. The average time difference for high and low tides, referred to Miami Beach, ranged from zero at Port Everglades to plus one hour and 40 minutes at Hollywood. (Woodard-USGS)
W71-01913

THE ENCROACHMENT OF THE SALT WATER IN KOITO RIVER MOUTH RESERVOIR,
Chiba Prefecture Industrial Water Dept. (Japan); and Mitsui Consultants Co., Ltd., Tokyo (Japan).
Tatsuya Ikeda, and Yasuo Miyake.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 103-110, 1969. 8 p, 6 fig, 2 tab.

Descriptors: *Saline water intrusion, *Reservoirs, *Computer programs, *Groundwater movement, Canal seepage, Reservoir leakage, Land reclamation, Drainage, Leaching, Saline soils, Wetlands.
Identifiers: Japan, Koito River, Koito Reservoir.

A computer program is presented to calculate seepage of saline water from a reclaimed salt marsh into a freshwater reservoir. The calculation is illustrated by the example of the Koito River Reservoir, Japan, which was constructed in a coastal excavation from which reclamation dike materials were taken. (Knapp-USGS)
W71-01942

PUMPING FROM A SHALLOW WATER AQUIFER IN A COASTAL REGION,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Hydraulic Engineering.
Norbert L. Ackermann, and Hung Tao Shen.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 67-75, 1969. 9 p, 2 fig, 1 ref.

Descriptors: *Groundwater movement, *Saline water-freshwater interfaces, *Saline water intrusion, Aquifers, Beaches, Mixing, Withdrawal, Water levels, Mathematical studies.
Identifiers: Coastal aquifers, Upconing.

A two dimensional study was made of the flow conditions produced by the pumping of water from a fresh water aquifer which was bounded on its lower surface by a stationary fluid of higher density (salt water) and bounded on its upper surface by a horizontal plane having a constant piezometric head. The withdrawal of the fresh water was produced by continuous pumping from a series of line sinks or drains spaced at periodic intervals in the fresh water region. The pumping produced upconing of the interface in the vicinity of the line sink and general rising of the level of the freshwater-saltwater boundary when compared to conditions which would exist in the absence of pumping or at decreased pumping rates. The result of the mathematical analysis describing the flow conditions is presented graphically in dimensionless form. (Knapp-USGS)
W71-01944

THE ANALYSIS OF THE FLOW OF LAYERED FLUIDS,
New South Wales Univ., Kensington, (Australia). Dept. of Civil Engineering.
I. R. Wood.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 271-280, 1969. 10 p, 6 fig, 5 ref.

Descriptors: *Stratified flow, *Model studies, *Open channel flow, *Density stratification, Laboratory tests, Flumes, Interfaces, Mathematics, Equations, Flow rates, Temperature, Salinity, Diffusion, Estuaries, Oceans, Foreign projects.
Identifiers: *Australia.

It has long been recognized that fluids within estuaries are stratified and sometimes this stratification occurs in distinct layers. The internal flows produced by this stratification affect the diffusion of heat and salinity within estuaries and it is therefore important to understand the methods used in normal open channel flows to the calculation of flows in multilayer systems. In a two layer system two control points occur, one at the minimum width and one at a position away from the minimum width. The ratio of the discharges in the two layers is determined by calculations made at the control point away from the position of minimum width and the total discharge is determined by calculation at the minimum width. Experimental data are presented. (Woodard-USGS)
W71-01959

THE PRODUCTION OF ZOOPLANKTON IN SOUTHAMPTON WATER,
Southampton Univ. (England).
J. E. G. Raymont, and B. G. A. Carrie.
Int. Revue ges. Hydrobiological, Vol 49, No 2, p 185-232, 1964. 16 fig, 12 tab, 42 ref.

Descriptors: *Thermal pollution, *Thermal power plants, Plankton, Primary productivity, Temperature, Breeding, Zooplankton, Phosphates, Industrial wastes, Chlorophyll.
Identifiers: Southampton water, Seasonal fluctuation, Benthic species.

Quantitative zooplankton samples (500 litres) have been taken by the pump method, using No. 10 net at regular intervals from 1954 to 1959 at two thermal electric generating stations, Marchwood and Calshot in Southampton water. During the later years of the investigation warm water effluents have caused temperature around Marchwood to be somewhat higher. Marked seasonal changes in 300 plankton density are observed and are described in this report. The nauplii of cirripedes dominate the zooplankton numerically over much of the year. The zooplankton declines from about September, but there is a fair autumn density, especially at Marchwood, due mainly to copepods. Investigations during 1958 and 1959 showed that at Marchwood high phosphate concentrations (each 40 mg PO sub 4 as P/sub m 3) occurred over winter. Although a marked reduction accompanied the main burst of phytoplankton, relatively high phosphates were found over much of the year. At Calshot the phosphate values, though exceeding those for the English Channel are lower than at Marchwood. Plankton production in Southampton water is probably thus dependent to a considerable extent on nutrients derived from runoff and pollution. No reduction in zooplankton density appears to have followed the small rise in temperature which has occurred in Southampton water during investigation contains 42 references. (Upadhyaya-Vanderbilt)
W71-02070

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SECOND REPORT ON DEVELOPMENT OF IMPROVED CELLULOSE ACETATE MEMBRANES FOR REVERSE OSMOSIS,
Hercules, Inc., Cumberland, Md. Allegany Ballistics Lab.
Mark E. Cohen, Michael A. Grable, and Billy M. Riggleman.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $0.75. Office of Saline Water Research and Development Progress Report No. 518, March 1970, 71 p, 16 fig, 20 tab, 8 ref. OSW Contract 14-01-0001-1647.

Descriptors: *Reverse Osmosis, *Membranes, *Desalination, Desalination processes, Semipermeable membranes.
Identifiers: *Hollow Fibers, *Asymmetric Membranes, *Composite Membranes, Cellulose Acetate, Cellulose Nitrate.

Improved hollow-fiber membranes were developed for reverse osmosis. Both asynmetric and composite membranes were investigated. These studies produced a new type of high flux asymmetric hollow-fiber membrane whose properties represent a significant advance in performance over current dense-walled, hollow-feiber membranes. Substantial progress was also made in the area of composite hollow-fiber membranes. The improved asymmetric hollow-fiber membranes, made of cellulose acetate, were prepared on a laboratory scale and performance tested singly and in bundles on brackish water feed. They deliver flux rates up to 2.3 gfd at 600 psi while rejecting 96.8% of the sodium chloride from a 5000 ppm solution. In contrast, dense-walled, hollow-fiber membranes exhibit flux rates of approximately 0.1 gfd under similar conditions. The new asymmetric hollow-fiber membranes withstand external pressures of at least 1,000 psi without collapse. Limited tests suggest that the flux decline rates of these membranes are similar to those of modified Loeb membranes. The feasibility of preparing asymmetric hollow-fiber membranes has been demonstrated. These membranes offer potential for further utilization in the development of economical and compact reverse osmosis modules. Their properties have not yet been fully optimized. (Horowitz-OSW)
W71-01746

MEMBRANES FOR REVERSE OSMOSIS BY DIRECT CASTING ON POROUS SUPPORTS,
Montana State Univ., Bozeman.
Robert L. Nickelson, E. A. Birkhimer, Darrel E. Coverdell, Juin-Yih Lai, and Donald G. J. Wang.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $1.00. Office of Saline Water Research and Development Progress Report No. 520, March 1970, 91 pa, 25 fig, 25 tab, 13 ref. OSW Grant No. 14-01-0001-672.

Descriptors: *Reverse Osmosis, *Membranes, *Desalination, *Porous Media, Desalination processes, Semipermeable membranes.
Identifiers: *Composite Reverse Osmosis Membranes, *Coated Porous Supports, Cellulose Acetate.

Cellulose acetate membranes cast under a variety of conditions on various support materials were tested with a standard 1% sodium chloride at different pressures. The objective was to examine the possibility of casting thin cellulose acetate membranes on the surface of porous materials that could serve to give mechanical strength to the membranes. Membranes cast from dilute cellulose acetate-acetone solutions onto a variety of commercially available filter materials were of poor quality. Attempts to cast ultra-thin layers of cellulose acetate on the supports always resulted in imperfect membranes. None of the support materials that were compatible with the casting solutions had enough mechanical strength to be advantageous. Membranes were then cast on flat porous supports using a ternary casting solution of cellulose acetate-formamide-acetone. Some of the best membranes gave reproducible results as follows: E400-25 cellulose acetate cast on epoxy filled fiberglass filter material (Versapor 6429) gave a product water flux of 21 GSFD with 95% salt rejection at 800 psi test pressure; E398-10 cellulose acetate cast on 2 micron pore size poly-vinyl chloride filter (Millipore) gave 21 GSFD with 97.3% salt rejection. The optimal casting solution for one support is not optimal for another so care must be taken in evaluating the performance of supports. (Horowitz-OSW)
W71-01747

A TRACER STUDY OF PRESCALING DEPOSITION OF SCALE FORMING COMPOUNDS ON CONTROLLED SURFACES,
North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
For primary bibliographic entry see Field 08G.
W71-01748

'INVESTIGATION OF MULTISTAGE FLASH PHENOMEAN IN A THREE-STAGE TEST SYSTEM',
American Machine and Foundry Co., Waterford, Conn. Cuno Div.
Fred Gilbert, and W. R. Williamson.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $2.75. Office of Saline Water Research and Development Progress Report No. 525, January 1970, 117 p, 15 tab, 30 fig, 2 ref. OSW Contract No. 14-01-0001-1253.

Descriptors: *Desalination, *Distillation, *Flash distillation, Testing, Desalination processes, Desalination plants.
Identifiers: M*Millstone Point Laboratory.

Multistage flash phenomena was investigated on a ten-stage flash module and a prototype flash test chamber. The investigation included determination of design parameters involving stage efficiency, heat transfer, mass transfer of liquid and vapors and effects of gas contamination. A two-stage flash test unit was rebuilt as a three-stage test device with the middle stage the test stage provided with fixed and movable thermocouple probes and velocity probes. The sides of the test stage were made of transparent sheet plastic to permit visual observation of the flash pattern both above and below the vapor-liquid interface. A test program was established to determine the empty stage non-equilibrium allowance for a range of test conditions, stage temperature, liquid level, flow rate and flashdown. Stage level measurements and interstage pressure drops and orifice areas were measured for all runs to determine interstage flow characteristics for a flashing stage. (Robinson-OSW)
W71-01749

EXPERIMENTAL DESALINATION TEST CELL AND MEANS FOR MEASURING THE CONCENTRATION POLARIZATION BOUNDARY LAYER IN A REVERSE OSMOSIS SYSTEM,
National Instrument Labs., Inc., Rockville, Md.
Herbert Goldsmith, and Houshang Lolachi.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.55. Office of Saline Water Research and Development Progress Report No 527, May 1970. 41 p, 15 fig, 6 ref. OSW Contract 14-01-0001-1799.

Descriptors: *Reverse osmosis, *Membranes, *Boundary layers, Test procedures, *Desalination.
Identifiers: Membrane characterization test cell, Concentration polarization build-up, Membrane phenomenological coefficients, *Silver microprobes.

The main objective of this work was the study and measure of the concentration polarization directly in a desalination system. The geometry of this system must be such as to allow the mounting of measuring sensors without perturbing the polarization boundary layer. An annular geometry with a membrane placed on the outer surface of the inner tube with an access port placed in the outer tube permitted access to the concentration polarization boundary layer that is formed on the membrane surface. An exact analytical solution for the polarization profile in an annulus was quite complicated due to the non-linear nature of the defining equations, therefore as a first step some simplifying assumptions were made along the lines used by other authors in dealing with problems of this nature. These assumptions were: (1) The fluid is incompressible; (2) The flow is laminar; (3) The water flux is constant; and (4) Salt rejection by the membrane is complete. The solution to the above simplified system served as a starting point for the analysis of experimentally determinant salt concentration profiles. Deviations from this simplistic model may be significant and will undoubtedly lead to further refinement of the assumptions and the use of more elaborate numerical calculations. (Horowitz-Office of Saline Water)
W71-01752

ANNUAL REPORT (FY 1968) WEBSTER TEST FACILITY AND ELECTRODIALYSIS TEST-BED PLANT, WEBSTER, SOUTH DAKOTA.
Mason-Rust, Louisville, Ky.

For sale by Superintendent of Documents, US Goverment Printing Office, Wash, DC, 20402 - Price $1.50. Office of Saline Water Research and Development Progress Report No 567, June 1970. 128 p, 38 fig, 15 tab, 2 ref, 4 append. OSW Contract No 14-01-0001-1733.

Descriptors: *Desalination, *Pilot plants, *Electrodialysis, *South Dakota, Water costs, Economics, Facilities.
Identifiers: Webster (S Dak).

This Annual Report presents the Webster, S. Dak desalination Test Bed Plant Maintenance and Operational history, and the Experimental Program as carried out during the period 1 July 1967 through 30 June 1968. The Test Bed Plant consists of the four stage Asahi Chemical Industry (ACI) electrodialysis process for desalination of brackish water. Well water of 1500 ppm TDS, 48 deg F is pretreated by potassium permanganate addition followed by manganese Zeolite filtration for iron removal. Anion membrane fouling continued to be a major problem. The fouling is thought to be caused by a poisoning of the anion exchange membrane due to 'organics' with some contribution from iron, although the exact fouling agents have not been identified. Nightly acid backwashing was found to be successful towards control of iron deposits and the alkaline scale problems associated with anion membrane poisoning; however, the acid backwashing accounted for 56% of the plant downtime. Increased plant amortization and chemical demand costs associated with a lime softening and carbon filtration pretreatment system is expected to be more than offset by savings due to minimization of foulding problems, plus elimination of one electrodialysis stage, plus an increased product recovery from 50% to 70%. Various commericially available membranes were tested at temperatures between 48 deg F and 135 deg F using lime softened and carbon filtered Webster water. (Knapp-USGS)
W71-01754

1969-1970 SALINE WATER CONVERSION REPORT.
Office of Saline Water, Washington, D.C.

For sale by Superintendent of Documents, US Goverment Printing Office, Washington, DC 20402 - Price $0.75. Office of Saline Water Executive Summary Report, 1970. 28 p, 6 fig, 1 tab, 10 photo.

Descriptors: *Desalination, *Reviews, Research and development, Pilot plants, Desalination apparatus, Desalination processes, Economics, Water costs.

The research and development program progressed toward reducing the costs of fresh water from all desalting processes. The desalination program has moved from the laboratory into field testing of desalting plants with capacities up to 2.6 million gpd. Nearly 700 plants of 25,000 gpd capacity or larger are in operation or under construction throughout the world. These plants are capable of producing nearly 300 mgd. OSW is constructing a water desalting test vehicle to advance distillation systems through the development of components applicable to large production plants. Although no large seawater desalting plants have been built to date, OSW has been developing the necessary technology for their construction. Desalting plants of 1 million gpd capacity are now producing fresh water from seawater for about $1 per 1000 gallons. Plants of 2.5 million gpd are producing 1000 gallons of fresh water for about 85 cents. Water from a recently completed 7.5 million gpd plant in Mexico is expected to cost about 65 cents per 1000 gallons. Both distillation and membrane technology enjoyed a rewarding year. The ultimate disposal of brine either as a concentrated solution or as dry salts is also being investigated. (Knapp-USGS)
W71-01755

DESALINATION USING WASTE HEAT FROM THERMAL POWER STATIONS,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
R. A. Tidball, and J. G. Gaydos.
French and German abstracts. 3rd International Symposium on Fresh Water from the Sea, held at Dubrovnik, Yugoslavia, September 13, 1970, Vol 1, p 2070217, 1970. 11 p, 5 fig, 2 tab, 4 ref.

Descriptors: *Distillation, *Flash distillation, *Thermal powerplants, Desalination processes, Thermal pollution, Desalination plants, Water costs, Economics.
Identifiers: Waste heat utilization.

The use of very large steam turbines in the United States has been accompanied by a trend toward designing for higher back pressures. These higher back pressures in the condenser allow economic production of desalted water by flashing the condenser outlet water through one or more stages of flash distillation. Design of the systems and the economics of the water produced are discussed. This analysis is based on a narrow range of conditions. Additional work is required to determine limiting conditions of sea water temperature, power demand and water needs, amortization rates, and operating characteristics. (Lang-USGS)
W71-01778

SALINE GROUND-WATER RESOURCES OF THE TULAROSA BASIN, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 03C.
W71-01870

NUCLEAR DESALINATION PROGRAM ANNUAL PROGRESS REPORT ON ACTIVITIES SPONSORED BY THE ATOMIC ENERGY COMMISSION FOR PERIOD ENDING OCTOBER 31, 1969,
Oak Ridge National Lab., Tenn.
T. D. Anderson, and W. E. Thompson.
Available from NTIS as ORNL-4538, $3.00 in paper copy, $0.95 in microfiche. ORNL-4538, May 1970. 52 p. Contract W-7405-eng-26.
Identifiers: *Desalination, *Nuclear power plants, *Irrigation systems, Desalination, Refining (Metallurgy), Costs.

Information is presented under the following headings: desalting plant system coupling studies; dual-purpose plant control studies; tradeoffs between electric power generation and transmission for large nuclear desalting plants; uncladmetal-fueled breeder reactor for desalting or power; metal-fueled pressurized-water reactors; general studies on agro-industrial complexes and of agricultural and industrial processes; applications of agro-industrial complexes; and Nuclear Desalination Information Center.
W71-01882

3B. Water Yield Improvement

LARGE SCALE DYNAMIC EFFECTS OF CLOUD SEEDING,
Aerometric Research, Inc., Goleta, Calif.
Keith J. Brown, and Robert D. Elliott.
Available from NTIS as PB-189 658, $3.00 in paper copy, $0.95 in microfiche. Final Report to Bureau of Reclamation, December 1969. 124 p, 3 tab, 32 fig, 12 ref. Contract 14-06-D-5963.
Identifiers: *Artificial precipitation, Statistical analysis, Atmospheric precipitation, Weather stations, Hygrometers, Storms, Nucleation, Ice, Cirrus clouds, Cumulus clouds, Wind, Convection (Atmospheric), Networks, Meteorological radar, Radar tracking, Cloud seeding, Winter.

The report covers a three and one half year study of the Large Scale Effects of Cloud Seeding. Included in this program was a statistical analysis of four long term operational cloud seeding projects and two randomized research type projects and finally a pilot field program to test the hypotheses developed in the statistical phase of the contract. The statistical analysis of past operational and research seeding projects showed considerable evidence that areas 70 to 150 miles downwind from the nuclei source were receiving increased precipitation during cloud seeding operations. In many cases the increases in the downwind area was equal or greater than those in the intended target areas. A field program conducted during the 1968-69 winter season essentially confirmed this finding. The field program consisted of a detailed analysis of raingage records from a dense gage network in and downwind from a randomized research program in Santa Barbara County, California. The observation and seeding unit employed on the combined project was a convective band embedded in a general storm system. The seeding was accomplished with a single ground source using a high output pyrotechnic device.
W71-01672

NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA,
Rural Affairs Study Commission, Richmond, Va.
S. Mason Carbaugh.
Available from NTIS as PB-189 752, $3.00 in paper copy, $0.95 in microfiche. October 20, 1969. 67 p.
Identifiers: *Economics, Virginia, *Natural resources, *Virginia, Soils, Water supplies, Air, Reviews, Rural areas, Population, Floods, Law, Terrain, Sanitary engineering, Land use, Zoning.

The report is essentially concerned with Virginia's soil, water, and air resources. Forestry, often considered a natural resource, is becoming increasingly thought of as a crop and is included under another study category. The State's mineral resources are also expected to be covered under the section on mining. Air as one of the more valuable natural resources is included herein as recognition of its importance in developing the rural areas of the State, and to emphasize the need for adequately considering it in future development plans. (See also W71-01879)
W71-01878

SUMMARY OF NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA.
Rural Affairs Study Commission, Richmond, Va.

Available from NTIS as PB-189 753, $3.00 in paper copy, $0.95 in microfiche. 1969. 9 p.
Identifiers: *Natural resources, *Virginia, *Rural areas, *Reviews, Soils, Water supplies, Air population, Predictions.

The report is essentially concerned with Virginia's soil, water and air resources. The development of these resources must be considered as a major factor in equipping Virginia's rural areas to absorb a larger share of the growing population. 1.5 million more people by 1980 and about 4.0 million more in 2000 than today will place greater demands and stresses on the soil, water, and air resources. (See also W71-01878)
W71-01879

3C. Use of Water of Impaired Quality

SALINE GROUND-WATER RESOURCES OF THE TULAROSA BASIN, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
J. S. McLean.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $2.75. Office of Saline Water R and D Progress Report No 561, June 1970. 128 p, 34 fig, 4 tab, 69 ref. OSW Agreement 14-01-0001-2091.

Descriptors: *Tularosa Basin, *Saline ground water, *Saline water, Aquifers, *Desalination, Saline water interfaces, Groundwater movement, Transmissivity, Specific yield, Water consumption, Saline water systems, Geohydrologic units, Water table.

The report describes the location, extent, and quality of saline ground water in the Tularosa Basin. It defines the volume of water of different ranges in concentration and the ease with which saline water can be recovered for conversion to fresh water. The altitude of isosaline surfaces and

thickness of the saline water zones are shown on maps of the entire basin and of the following detailed areas within the basin: Alamogordo, Tularosa, Carrizozo, and the Western margin of the basin. The most widely developed aquifer in the basin is the alluvial fill of tertiary to Holocene age which exceeds 6,000 feet in thickness in the southern part of the basin. Well yields of as much as 1,400 gallons per minute have been measured. (Sachs-Office of Saline Water)
W71-01870

FILTRATION PROBLEMS OF IRRIGATING AND WASHING SALINIZED SOILS,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-01945

IRRIGATION WITH RECLAIMED WASTEWATER,
Hirsch and Koptionak, San Diego, Calif.
For primary bibliographic entry see Field 05D.
W71-02103

3D. Conservation in Domestic and Municipal Use

PRICE, DEMAND, COST, AND REVENUE IN URBAN WATER UTILITIES.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 06D.
W71-01837

LONG ISLAND WATER RESOURCES.
New York State Office of Planning Coordination, Albany.
For primary bibliographic entry see Field 06D.
W71-01988

DEVELOPMENTS IN WATER SYSTEM NETWORK DESIGN,
All-India Inst. of Hygiene and Public Health, Calcutta.
V. Raman.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA5, p 1249-1263, October 1970. 50 ref.

Descriptors: *Water distribution (Applied), *Network design, *Networks, Water supply, Systems analysis, Operations research, Optimization, Mathematical models.

The systematic design of a water distribution system network has so far been an exception rather than a routine matter due to the labor and time involved in the process. New methods that have come into vogue have relieved much of the time-consuming and tedious nature of the analysis. The developments in the hydraulic analysis from trial and error and Hardy Cross methods, to electric pipeline analyzer and digital computing methods, the evolution of methods for systems balance, and direct and optimum design of water distribution networks, are presented. The respective advantages and limitations of each method are brought forth. Studies of the various methods show that lacunae still exist in the systems analysis and optimal design of water system network. (Davis-Chicago)
W71-02113

3E. Conservation in Industry

STOCHASTIC IRRIGATION PLANNING MODELS,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 06A.
W71-02096

WATER USE EFFICIENCY IN THE DAIRY PROCESSING AND THE MEAT PACKING INDUSTRIES IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
Dennis D. Hackbart.
MS Thesis, Dept. of Agricultural Economics, University of Nebraska, May 1967. 61 p, 9 ref, 11 tab, 3 fig. OWRR Project A-004-NEB (4).

Descriptors: *Water allocation (Policy), Industrial use (Water), Water costs, Water cooling.
Identifiers: *Nebraska, University of California, Texas A and M University.

By analyzing in detail the water use policies of the dairy processing and meat packing industries in Nebraska, the author attempted to determine the relationship between the amount of water used, quantity of product produced, profit accrued and employment created for each industry. In addition, the economic feasibility of water saving technologies such as recirculation of water and automated cleanup processes in the industries was determined. The author concluded that although neither industry considered water costs to be a major expense, they did adopt water saving technologies in order to reduce water ecquisition costs. He also found that the dairy processing industry created more employment for each acre foot of water used than did the meat packing industry. However, the dairy processing industry added only one-third the value to its product per acre foot of water used as did the meat packing industry. (Holmes-Rutgers)
W71-02110

3F. Conservation in Agriculture

SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION, SAN JUAN COUNTY,
New Mexico Agricultural Experiment Station, University Park.
H. J. Maker, C. W. Keetch, and J. U. Anderson.
Supported in part by funds provided by U. S. Department of Interior, as authorized under The Water Resources Research Act of 1964, Public Law 88-379. Available from NTIS as PB-195 826, $3.00 in paper copy, $0.95 in microfiche. September 1969. 40 p, 8 tab, 2 fig, 10 ref. Research Report 161. OWRR Project B-014-NMEX (3).

Descriptors: *Planning, *Land appraisal, *Irrigable land, *Land classification, *Soil classification, Irrigation water, New Mexico, Arid lands, Soil surveys, Soil types, Soil properties, Mapping, Data collections, Climatic data, Soil engineering, Irrigated land, Land use, Water allocation (Policy).
Identifiers: *Soil associations, *Irrigated crop, San Juan County (New Mexico).

The San Juan County general soil map was used to estimate the amount of irrigable land in each soil area. Approximately 38 percent of the soils (1,341,500 acres) are suitable as cropland under irrigation. Irrigable land is widely distributed and frequently occurs in small tracts, which limits its use for irrigation. The 18 soil associations are rated according to federal Water Resources Council's criteria which consider texture, moisture retention, depth, salinity, sodic conditions, permeability, erosion, topography and drainage. The soils are also classified according to the AASHO and the Unified systems. Topography, climate, land use, soil characteristics, present land use and irrigation potential are examined. The soils are reviewed for irrigation and engineering uses to provide information for preliminary planning for forestry, range, urban, engineering, recreation, wildlife and irrigation development. Tables show climatic data, soil characteristics, land classification criteria, irrigation land classes for soils and engineering soils. Figures show soil and irrigable land distribution. (Popkin-Arizona)
W71-01653

LAND CLASSIFICATION FOR IRRIGATION, CURRY COUNTY,
New Mexico Agricultural Experiment Station, University Park.
H. E. Dregne, J. U. Anderson, and H. J. Maker.
Supported in part by funds provided by U. S. Department of the Interior as authorized under Water Resources Act of 1964, Public Law 88-379 and by federal funds from the Water Resources Council. Available from NTIS as PB-195 827, $3.00 in paper copy, $0.95 in microfiche. October 1969. 8 p, 4 tab, 3 fig, 3 ref. Research Report 162. OWRR Project B-014-NMEX (2).

Descriptors: *Planning, *Land appraisal, *Irrigable land, *Land classification, *Soil classification, Irrigation water, New Mexico, Arid lands, Soil surveys, Soil properties, Mapping, Water allocation (Policy), Data collections, Soil types, Irrigated land.
Identifiers: *Soil association, *Irrigated crop, Curry County (New Mexico).

New Mexico is severely deficient in irrigation water supplies for expansion. Limited (expensive) water should be used on the most productive soils. This report which updates a 1968 publication shows the distribution and acreage of irrigable land in Curry County in easter New Mexico. Based on soil qualities, approximately 94 percent (or 840,000 acres) of the county, or five times the acreage of presently irrigated land, is suitable for irrigation. Irrigable land is widely distributed in fairly extensive areas. Irrigation will be limited by water supplies and economic restrictions rather than by the availability of suitable soils. A detailed soil survey of Curry County was published by the Soil Conservation Service (1958). Irrigable acreage was determined by cutting out and weighing each delineated soil-mapping unit from the map sheets in the survey report. Soil-mapping units were rated according to five classes of irrigability, using federal Water Resources Council criteria of texture, moisture retention, depth, permeability, erosion, slope, surface smoothness and drainage. Tables show soil-classification criteria, irrigable and non-irrigable land percentages, acreage and extent of 48 soil types and percentage of land in various irrigation classes. Figures show distribution of irrigation land classes and percent of irrigable land by township. (Popkin-Arizona)
W71-01654

STUDIES ON THE INFLUENCE OF MIST IRRIGATION ON THE MICROENVIRONMENT, GROWTH, AND DEVELOPMENT OF THE POTATO (SOLANUM TUBEROSUM),
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 02I.
W71-01656

SOIL - CROP - TILLAGE INTERACTIONS IN DRYLAND AND IRRIGATED FARMING,
Hebrew Univ., Jerusalem (Israel). Faculty of Agriculture.
Daniel Hillel, D. Ariel, S. Orlowski, E. Stibbe, and D. Wolf.
Available from NTIS as PB-190 438, $3.00 in paper copy, $0.95 in microfiche. Final Technical Report, US Dept of Agriculture, 1969. 300 p, 12 tab, 48 ref. A10-AE-3.
Identifiers: *Soils, Management planning, *Management planning, Irrigation systems, Site selection, Wheat, Grasses, Moisture, Rotation, Plants (Botany), Israel, Tillage, Dryland farming.

The project was an attempt to find answers to a number of fundamental and practical problems related to soil management in an arid zone. Though the practice of tillage constitutes a major, and at times the major, cost item in crop production, it has not yet been studied adequately from the combined viewpoints of the agronomist, soil physicist and engineer. A coordinated effort was directed towards an examination of alternative tillage programs and practices in the contexts of dryland and irrigated farming under the conditions typically prevailing in Israel.

W71-01680

SOIL MOISTURE CHARACTERISTICS OF INDIAN GRUMOSOLS AS RELATED TO WHEAT PRODUCTION UNDER UNIRRIGATED CONDITIONS,
Jawaharlal Nehru Agricultural Univ., Jabalpur (India).
Y. D. Tiwari, T. A. Singh, and P. M. Tamboli.
Annals of Arid Zone, Vol 9, No 1, p 26-30, March 1970. 2 fig, 5 tab, 4 ref.

Descriptors: *Crop production, *Clays, *Soil moisture, *Wheat, *Soil physical properties, Water conservation, Montmorillonite, Infiltration, Hydraulic conductivity, Soil profiles, Soil water movement, Soil structure, Surface drainage, Rainfall, Monsoons, Crop response, Soil-water-plant relationships, Data collections, Water storage, Retention, Drainage practices.
Identifiers: *India, *Grumosols, *Bunding.

Bunding is a common practice in Indian monsoon areas and involves the blockage of drainage channels around 'Kheri' clay (grumosol) fields. Water accrued from monsoons is stored until about a month before planting winter crops, thus bringing about weed destruction and greater soil water retention. For testing the actual effects of bunding, adjacent bunded and unbunded soils were compared over 3 years (1964-67) for moisture retention and depletion, soil physical properties and wheat yield. Being argillaceous and high in montmorillonitic minerals, the soils were quite adhesive, swelled when wet, cracked when dry and had poor infiltration rates and hydraulic conductivities. Bunded soils had higher moisture storage and higher wheat yields, particularly in unusually low rainfall years. (Casey-Arizona)
W71-01703

SUBSURFACE APPLICATION AND SHALLOW INCORPORATION OF HERBICIDES ON COTTON,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 02I.
W71-01704

ECOLOGICAL STUDIES ON THE GRASSLANDS OF JHANSI, U.P.,
Indian Grassland and Fodder Research Inst., Jhansi (India).
K. A. Shankarnarayan, and P. M. Dabadghao.
Annals of Arid Zone, Vol 9, No 1, p 54-63, March 1970. 1 tab, 9 ref.

Descriptors: *Grasslands, *Biological communities, *Ecology, *Soil-water-plant relationships, *Soil physical properties, Soil texture, Soil profiles, Soil moisture, Soil types, Topography, Succession, Grasses, Legumes, Weeds, Pasture management, Geology, On-site investigations, Climate, Productivity, Depth, Distribution.
Identifiers: *India, *Forest grasslands, *Floristic affinities, *Soil depth, Anthropogenic effects.

Indian grasslands are considered intermediate between a forest climate and a desert climate and are stable preclimax communities. Around Jhansi the area is composed of varied grassland communities. Three genetic soil types were distinguished on the basis of profile developmental characteristics. Variations in soil properties have probably been generated by topographical variations. The climate and geology of the area are described. Using line transects during the primary growth period, differing grass communities were identified on the basis of dominant species composition and analyzed for soil and topographical characters. Nine communities were identified and described. Apparently, soil moisture status as influenced by topography, soil depth and soil texture determines community distribution. Floristic affinities indicate the communities are intergrading due to the operation of progressive and retrogressive succession aided by anthropogenic factors. Procedures are outlined for elimination of less productive species and introduction of more desirable species. (Casey-Arizona)
W71-01707

THE INFLUENCE OF TILLAGE PRACTICES ON YIELDS AND WEED CONTROL IN SAFFLOWER,
Nebraska Univ., Lincoln. Dept. of Agronomy; and Lincoln Univ., Mitchell. Scotts Bluff Experiment Station.
For primary bibliographic entry see Field 02I.
W71-01711

CONTROL OF WILD CANE IN SOYBEANS,
Nebraska Univ., Lincoln. Dept. of Agronomy.
O. C. Burnside.
Nebraska Agricultural Experiment Station, Journal Series, Paper No 2084. Weed Science, Vol 16, No 1, January 1968, p 18-22. 4 tab, 2 fig, 7 ref.

Descriptors: *Weed control, *Soybeans, *Herbicides, *Crop response, *Plant growth regulators, Weeds, Crop production, Sorghum, Cultivation, Nebraska, Semiarid climates, Depth, Competition, Seeds, On-site investigations, Greenhouses.
Identifiers: *Crop management, *Wild cane, *Weed infestation, *Herbicide application, Sorghum production, Trifluralin, Vernolate.

Wild cane (Sorghum bicolor (L.) Moench) is a tall forage-type sorghum found in Nebraska and other semiarid lands. The seed either shatters or otherwise gets to the soil, remains viable, emerges in ensuing years and causes an encroachment on soybean production. Wild cane competes for soil moisture with other plants. Greenhouse and field studies showed that alpha, alpha, alpha-trifluro-2, 6-dinitro-N, N-dipropyl-p-toluidine (trifluralin) gave better control of wild cane when incorporated in the soil above rather than below the wild cane seed. Of four herbicides studied in the field experiments, trifluralin gave the best control of wild cane in soybeans followed by S-propyl dipropylthiocarbamate (vernolate). Herbicides were more effective than cultivation in controlling wild cane, but neither alone was adequate. A combination of cultivation plus herbicides markedly increased soybean yield on wild cane infested areas. These results show that an economical soybean crop can be produced on wild cane-infested land. Tables of greenhouse and field wild cane growth as affected by planting depth, and trifluralin application for 1964 to 1966, and photographs of wild cane control are presented. (Popkin-Arizona)
W71-01713

WESTERN WHORLED MILKWEED AND ITS CONTROL,
Agricultural Research Service, Lincoln, Nebr. Crops Research Div.
M. K. McCarty, and C. J. Scifres.
Nebraska Agricultural Experiment Station, Journal Series, Paper No 2031. Weed Science, Vol 16, No 1, January 1968, p 4-7. 3 tab, 1 fig, 4 ref.

Descriptors: *Weed control, *Brush control, *Poisonous plants, *Herbicides, *Plant growth regulators, 2-4-D, 2-4-5-T, Arid lands, Rates of application.
Identifiers: *Western whorled milkweed, *Herbicide efficiency, *Picloram, Dicamba, Silvex, Amitrole.

Western whorled milkweed (Asclepias subverticillata (Gray) Vail), a poisonous pasture weed, can spread from scattered clumps to an almost solid, uniform stand in a few years. It is highly toxic to cattle. The most effective herbicide was 4-amino-3,5,6-trichloropicolinic acid (picloram). Application of 2-methoxy-3,6-dichlorobenzoic acid (dicamba) gave only fair results. 2,4-dichlorophenoxyacetic acid (2,4-D),2,4-5-trichlorophenoxyacetic acid (2,4,5-), 2- (2,4,5-trichlorophenoxy) propionic acid (silvex), and 3-amino-1,2,4-triazole (amitrole) gave ineffective control. Addition of amitrole did not enhance effectiveness of dicamba or picloram. Tables of pretreatment and post-treatment specie density and a photograph of the species in bloom are included. (Popkin-Arizona)
W71-01715

LOSS OF HERBICIDES IN RUNOFF WATER,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
For primary bibliographic entry see Field 05B.
W71-01716

ARTIFICIAL GROUNDWATER RECHARGE THROUGH BASINS IN THE TEXAS HIGH PLAINS,
Agriculture Research Service, Bushland, Tex.
For primary bibliographic entry see Field 04B.
W71-01719

PREDICTION OF ORIFICE DISCHARGE AND HEAD LOSS ALONG A SMALL DIAMETER TERMINAL PERFORATED PIPE,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01776

CONSUMPTIVE USE OF WATER BY SUGARCANE IN HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02D.
W71-01902

RUMANIAN IRRIGATION.
For primary bibliographic entry see Field 08A.
W71-01905

ADVANCE OF IRRIGATION WATER ON THE SOIL SURFACE IN RELATION TO SOIL INFILTRATION RATE: A MATHEMATICAL AND LABORATORY MODEL STUDY,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W71-01964

THE OUTLOOK FOR WASTE WATER UTILIZATION IN ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Labs.
For primary bibliographic entry see Field 05D.
W71-02104

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06C.
W71-02107

ALLOCATING A LIMITED SUPPLY OF WATER FOR IRRIGATION,
Nebraska Univ., Lincoln.
Carl B. Lewis.
PhD Thesis, University of Nebraska, June 1969. 135 p, 55 tab, 55 ref. OWRR Project A-004-NEB (5).

Descriptors: *Water allocation (Policy), Irrigation programs, Comparative benefits, Budgeting, Comparative costs.
Identifiers: *Linwood Unit, Nebraska, Platte River.

This thesis developed and tested procedures for planning the most economically beneficial allocation of limited surface water supplies for irrigation purposes. The author examined four alternative schemes for irrigating land along the Platte River in Butler and Saunders Counties in Nebraska. The four plans were to irrigate 10,500 or 21,000 acres

from a stored water supply, or from water diverted directly to the land from the river. After presenting a detailed comparison of costs for each scheme, he concluded that irrigating 21,000 acres with water diverted directly from the river would achieve the 'highest net social product.' In addition, the author determined that the most economic way of allocating water during periods of water shortage was to irrigate 'crops in order of the ranking of returns over variable costs'. This plan, he concluded, was more economic than watering all crops uniformly. (Holmes-Rutgers)
W71-02108

IRRIGATION WATER SUPPLY: EFFICIENCY AND COST ASPECTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
Ronald D. Cacek.
MS Thesis, Dept. of Agricultural Economics, University of Nebraska, May 1970. 55 p, 23 tab, 1 fig, 14 ref. OWRR Project A-004-NEB (3).

Descriptors: *Irrigation efficiency, Cost comparisons, Water costs.
Identifiers: *Bureau of Reclamation, Nebraska, Farwell, Sargent and Ainsworth Irrigation Districts.

The comparative efficiencies of three irrigation projects in central Nebraska were tested. Measurements were made of the amounts of water delivered to the user in relation to the amount of water which entered the irrigation system and the cost of delivery. The author concluded that the concrete lined system was more efficient in relation to costs of irrigation than the other two. (Holmes-Rutgers)
W71-02109

TILLSON V CRANE BROOK CO (LIABILITY FOR THE NEGLIGENT LOWERING OF WATER LEVELS).
For primary bibliographic entry see Field 06E.
W71-02198

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

YOUNG V SCOTT (LIABILITY FOR OBSTRUCTION OF FLOW OF SURFACE WATER FROM DOMINANT ESTATE).
For primary bibliographic entry see Field 06E.
W71-01655

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 06A.
W71-01658

MILLER V ZAHN (DOMINANT ESTATE'S LIABILITY FOR COLLECTION AND DISCHARGE OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-01661

GEISERT V CHICAGO R I AND P RY (SERVIENT LANDS MUST SUFFER CONSEQUENCES OF UNRESTRAINED FLOW OF DRAINAGE FROM DOMINANT ESTATES).
For primary bibliographic entry see Field 06E.
W71-01674

EHLER V STIER (NULLIFICATION OF EASEMENT FOR DRAINAGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01682

LYON V WATER COMM'RS OF CITY OF BINGHAMTON (RIGHT OF RIPARIAN OWNER TO FULL FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-01692

HAMMOND V ANTWERP LIGHT AND POWER CO (LIMITATIONS ON PRESCRIPTIVE RIGHT TO DIVERT STREAM FLOW).
For primary bibliographic entry see Field 06E.
W71-01693

FLOOD PLAIN INFORMATION, TUSCARAWAS RIVER, STARK COUNTY, OHIO.
Corps of Engineers, Huntington, W. Va.

Prepared for State of Ohio, Dept of Natural Resources. Corps of Engineers Flood Plain Report, January 1970. 45 p, 9 fig, 14 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Ohio, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Stark County (Ohio), Standard project flood, Intermediate regional flood.

Flooding along the Tuscarawas River within Stark County, Ohio is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known for the past 100 years occurred in March 1913 and remained at flood stage for some 140 hours. Standard project flood determinations indicate that the upper limit of flooding would be about 5 feet higher than the 1913 flood. (Woodard-USGS)
W71-01773

FLOOD PLAIN INFORMATION, EAST FORK STONES RIVER, WOODBURY, TENNESSEE.
Corps of Engineers, Nashville, Tenn.

Prepared for town of Woodbury, Tenn. Corps of Engineers Flood Plain Report, August 1970. 35 p, 8 fig, 9 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Tennessee, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Woodbury (Tenn) area, Standard project flood, Intermediate flood.

Flooding along East Fork Stones River in the vicinity of Woodbury, Tennessee is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known at Woodbury since 1902 occurred March 11, 1963 and crested at a stage of 16.52 feet (elev. 692.8) at the USGS gage. Other large floods occurred in Jan 1937, Feb 1948, June 1952, and March 1955. Main flood season is winter and early spring, but flooding from intense local storms can occur nearly all times of the year. Water velocities during major floods range up to 8 feet per second in the channel of East Fork Stones River. (Woodard-USGS)
W71-01774

WASHINGTON WATER CO V PARRETT (DAMAGES FROM DAM OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-01811

BIRCH V BOSTON AND M RR (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W71-01871

A METHODOLOGY FOR FLOOD PLAIN DEVELOPMENT AND MANAGEMENT.
TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 06F.
W71-01872

BELCASTRO V NORRIS (DRAINAGE RIGHTS ACROSS ADJOINING PROPERTY).
For primary bibliographic entry see Field 06E.
W71-01873

HOGAN V PENNSYLVANIA RR (ALLEGEDLY INADEQUATE CONDUIT NOT PROXIMATE CAUSE OF FLOODING).
For primary bibliographic entry see Field 06E.
W71-01874

PUBLIC POLICY AND SHORELINE LANDOWNER BEHAVIOR,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 06E.
W71-01888

NATURAL OIL SEEPAGE AT COAL OIL POINT, SANTA BARBARA, CALIFORNIA,
General Research Corp., Santa Barbara, Calif., and California Univ., Santa Barbara. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05B.
W71-01904

FLOOD PLAIN INFORMATION-SOUTH FORK OF THE CROW RIVER, HUTCHINSON, MINNESOTA.
Corps of Engineers, St. Paul, Minn.

Corps of Engineers Flood Plain Report, April 1970. 43 p, 27 fig, 14 plate, 7 tab.

Descriptors: *Floods, *Flood damage, *Minnesota, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood recors, *Hutchinson (Minn.), Standard project flood, Intermediate regional flood.

Flooding along the South Fork of the Crow River within the city of Hutchinson, Minnesota is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The greatest flood known to have occurred on the South Fork at Hutchinson occurred in April 1965 with an estimated peak discharge at Hutchinson of about 4,700 cubic feet per second. The total estimated damages including urban, residential, and business damage and Red Cross, National Guard, and emergency flood protection, were $320,000. Of the total damages sustained, the reach below the dam suffered damages estimated at $276,000, whereas damage above the dam was estimated to be $44,000 based on 1965 prices and conditions of development. (Woodard-USGS)
W71-01915

FLOOD PLAIN INFORMATION, BIG WILLIS CREEK, VICINITY OF GADSDEN, ALABAMA.
Corps of Engineers, Mobile, Ala.

Corps of Engineers Flood Plain Report, May 1970. 31 p, 3 fig, 23 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Alabama, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Gadsden (Ala), Standard project flood, Intermediate regional flood.

Flooding of Big Wills Creek, Gadsden, Alabama is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. The greatest flood known to have occurred on Big Wills Creek was the flood of December 29, 1942. There are no damage estimates available for this flood, although several homes along the stream were inundated. The April 1886 flood is the greatest recorded on the Coosa River at the Highway 431 bridge gaging station in Gadsden, 1.76 river miles upstream from the mouth of Big Wills Creek. (Knapp-USGS)
W71-01916

LINDENMUTH V SAFE HARBOR WATER POWER CORP (EASEMENT FOR FLOODING CAUSED BY DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-01924

RICHARDSON V TUMBRIDGE (NON-USE OF EASEMENT NOT TANTAMOUNT TO ABANDONMENT).
For primary bibliographic entry see Field 06E.
W71-01928

GENERAL CHARACTERIZATION OF DIFFERENT TYPES OF SEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gyorgy Kovacs.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 205-214, 1969. 10 p, 1 fig, 10 ref.

Descriptors: *Groundwater movement, *Seepage, *Darcy's law, Hydraulic conductivity, Mathematical studies, Model studies, Velocity, Reynolds number, Viscosity.

Dynamic seepage through porous media can be divided into different types of movement according to the main active and passive forces by which the flow condition is influenced. A series of dimensionless numbers can be calculated to determine the general form of the equations of movement for each zone and to characterize numerically the limits of different types of seepage. The functions by which Darcy's hydraulic conductivity should be multiplied for characterization of the different types of seepage are listed. (Knapp-USGS)
W71-01935

A STUDY ON THE SEEPAGE FLOW OUT OF A FRESH WATER CANAL IN THE GROUND SATURATED WITH SEA WATER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
Masatsune Sakiyama, and Toshihiko Ueda.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 95-102, 1969. 8 p, 5 fig, 3 photo, 1 ref.

Descriptors: *Saline water-freshwater interfaces, *Seepage, *Groundwater movement, *Saline water intrusion, *Canal seepage, Path of pollutants, Mathematical studies, Model studies, Hydraulic models.
Identifiers: Coastal aquifers, Japan.

Fundamental model investigations were made on preventing seepage of salt water into sea-side reservoirs and salt nuisance near coasts. When a fresh water ditch is constructed in ground saturated with sea water, the fresh water pushes down the salt water and the seepage flow reaches a steady state. The fresh-salt interface, the seepage discharge, and the stream lines in the domain of the fresh water were studied by the theory of complex potential for two dimensional flow; and their results were ascertained by sand model tests. (Knapp-USGS)
W71-01943

FILTRATION PROBLEMS OF IRRIGATING AND WASHING SALINIZED SOILS,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-01945

SOME DYNAMIC PROBLEMS OF THE MECHANICS,
For primary bibliographic entry see Field 08B.
W71-01946

RELATIONSHIP BETWEEN VELOCITY OF SEEPAGE AND HYDRAULIC GRADIENT IN THE ZONE OF HIGH VELOCITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 08B.
W71-01947

BURKE V BOSTON AND M RR (RAILROAD'S LIABILITY FOR DEATHS CAUSED BY ROADBED WASHOUT).
For primary bibliographic entry see Field 06E.
W71-01949

SEEPAGE LAW FOR MICROSEEPAGE,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gyorgy Kovacs.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 1-7, 1969. 7 p, 2 fig, 9 ref.

Descriptors: *Seepage, *Groundwater movement, *Darcys law, *Hydraulic conductivity, Fluid friction, Hydraulic gradient, Soil water movement, Capillary conductivity, Diffusion, Laminar flow, Adhesion.
Identifiers: Poiseuille's equation, Non-Newtonian flow.

To calculate seepage which has a very small velocity, it is necessary that the non-Newtonian behavior of the fluid be taken into account. In this zone of seepage, where Darcy's law is not valid, gravity is balanced by friction and adhesion. The original Poiseuille's equation was modified to include the effect of adhesion. The mean velocity taking into consideration the effect of molecular forces (adhesion) is the same as the quotient of the velocity of micoroseepage and the velocity of seepage determined by multiplying the gradient with Darcy's hydraulic conductivity. Thus the correct equations of movement for both the zone of microseepage and the zone of laminar movement can be derived. (Knapp-USGS)
W71-01950

THE PREDICTION OF WITHDRAWAL LAYER THICKNESS IN DENSITY STRATIFIED RESERVOIRS,
Tennessee Valley Authority, Norris. Engineering Lab.
For primary bibliographic entry see Field 02H.
W71-01954

LOUISVILLE AND NASHVILLE RR V MIDDLETON (LIABILITY FOR DAMAGE FROM OVERFLOW OF DRAINAGE WATER CAUSED BY ROAD CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-01958

CHICAGO, ST L AND N O RR V HICKS (RAILROAD'S LIABILITY FOR FLOOD DAMAGE CAUSED BY ERODED EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-01963

DE KALB COUNTY V TENN ELEC POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM OVERFLOW DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-01965

DEASON V SOUTHERN RY (DAMAGES FOR OBSTRUCTION TO DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02012

BENNETT V CUPINS (LIABILITY FOR DIVERSION OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02058

ANTON V STANKE (UPPER PROPRIETOR'S LIABILITY FOR DAMAGE CAUSED BY HIS DIVERSION OF DRAINAGE WATER).
For primary bibliographic entry see Field 06E.
W71-02065

HERMAN V DREW (LANDOWNER MAY NOT INTERFERE WITH HIGHWAY DRAINAGE SYSTEM WHICH FOLLOWS THE NATURAL COURSE OF LAND'S DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02072

SIMONSON V ALDEN TOWNSHIP (LIABILITY FOR DRAINAGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02077

THOMPSON V BOARD OF SUPERVISORS (RELIEF FROM ADMINISTRATIVE RULINGS).
For primary bibliographic entry see Field 06E.
W71-02078

OPTIMUM DESIGN OF COMPLEX WATER RESOURCE PROJECTS,
Rand Water Board, Johannesburg (South Africa).
For primary bibliographic entry see Field 06A.
W71-02088

A TWO-STEP PROBABILISTIC MODEL OF STORAGE RESERVOIR WITH CORRELATED INPUTS,
Toronto Univ. (Ontario).
V. Klemes.
Water Resources Research, Vol 6, No 3, p 256-267, June 1970. 12 p, 8 fig, 10 ref.

Descriptors: *Probability, *Transition flow, *Markov processes, *Reservoir storage, *Reservoir operation, *Input-output analysis, Monthly, Flows, Annual, Model studies.

Identifiers: *Moran's storage model, *Lloyd's model, *Gould's concept of transition probabilities, Transition matrix.

Fragmentation of Moran's storage model and decomposition of its transition matrix into a release rule and an input component were used to simplify the problem formulation for reservoirs with complex operating rules and to derive the Lloyd model directly from that of Moran by introducing two successive transitions of one variable instead of a single bivariate transition. Combined with Gould's concept of transition probabilities, the suggested model was used to take into account the correlation between monthly flows simultaneously with that between annual flows. The process of reservoir input was also concerned as a first-order Markov chain. Complete descriptions and illustrations of the schemes were given. (Kriss-Cornell)
W71-02090

FARRAR V SHUSS (RIGHTS OF SERVIENT LANDOWNER TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
For primary bibliographic entry see Field 06E.
W71-02124

WINCHESTER WATER WORKS CO V HOLLIDAY (WATER COMPANY'S LIABILITY FOR DAMAGES RESULTING FROM BUILDING OF A FLASHBOARD DAM).
For primary bibliographic entry see Field 06E.
W71-02131

BOARD OF TRUSTEES OF TOWN OF AUBURN V CHYLE (CITY NOT LIABLE FOR FLOODING CAUSED BY STREET DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02132

BABER V GRIGGS (LIABILITY FOR DIVERTING SURFACE WATER FROM ROADWAY ONTO ADJACENT LAND).
For primary bibliographic entry see Field 06E.
W71-02133

PLANNING STANDARDS FOR STORM DRAINAGE,
Kansas City Public Works, Mo.
Myron D. Calkins.
Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 96, No UP1, p 53-58, March 1970.

Descriptors: *Drainage, *Planning, *City planning, *Runoff, *Drainage engineering, *Standards, Urbanization, Drainage practices, Drainage program, Sewers.
Identifiers: *Regional planning, Public works, Comprehensive storm drainage networks.

Designers of comprehensive storm drainage networks must consider all storm water flow tributary to watershed areas. The presence of governmental boundary lines which do not coincide with these watersheds introduces complicating factors to such designs. Cooperation between engineers responsible for planning in these jurisdictions can produce a unified design result for entire drainage networks. The Kansas City metropolitan area achieves such cooperation by adopting unified design standards produced by local engineers. These standards include accepted criteria for all phases of storm drainage problem analysis and plan preparation. Results of the use of these criteria by agencies throughout the metropolitan area include uniform designs, stage construction of drainage networks, and a more comprehensive understanding by local officials of mutual problem solutions. (Davis-Chicago)
W71-02146

LAKE MICHIGAN DEVELOPMENT PROPOSAL.
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02156

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY OF LICENSEE FOR MAINTENANCE OF FLASHBOARDS ON FEDERAL DAM).
For primary bibliographic entry see Field 06E.
W71-02159

GULF STATES STEEL CO V LAW (LIABILITY FOR FLOOD DAMAGE BY DAM OWNER).
For primary bibliographic entry see Field 06E.
W71-02166

ILHENNY V BROUSSARD (DIVERSION OF WATERS FROM NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.
W71-02170

VOLENTINE V HOUSEMAN (LIABILITY FOR OBSTRUCTING DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W71-02172

SCRANTON-PASCAGOULA REALTY CO V CITY OF PASCAGOULA (ARTIFICIAL CHANNEL MAY BECOME WATERCOURSE BY PRESCRIPTION).
For primary bibliographic entry see Field 06E.
W71-02173

MARTIN V LOUISIANA PUB UTIL CO (RIGHTS OF PARTIES UNDER WATER CONTRACT).
For primary bibliographic entry see Field 06E.
W71-02174

HAASE V KINGSTON CO-OPERATIVE CREAMERY ASS'N (OWNERSHIP OF LAND UNDER ARTIFICIAL LAKE).
For primary bibliographic entry see Field 06E.
W71-02177

DELTA FISH AND FUR FARMS V PIERCE (STATUS OF WATERS PREVIOUSLY ADJUDGED NON-NAVIGABLE).
For primary bibliographic entry see Field 06E.
W71-02179

PFANNEBECKER V CHICAGO RI AND P RY (LIABILITY FOR DAMAGES RESULTING FROM TWO OR MORE CAUSES).
For primary bibliographic entry see Field 06E.
W71-02180

PIKE RAPIDS POWER CO V SCHWINTEK (SPECIFIC PERFORMANCE OF CONTRACT TO CONVEY FLOWAGE RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02181

BEAVERTON POWER CO V WOLVERINE POWER CO (BREACH OF ORAL CONTRACT TO CONVEY FLOWAGE RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02182

ANDERSON V OTTER TAIL POWER CO (LIABILITY FOR BREACH OF COVENANT TO PROVIDE POWER FROM DAM).
For primary bibliographic entry see Field 06E.
W71-02183

CITY OF BARABOO V RAILROAD COMM'N (JUDICIAL REVIEW OF ADMINISTRATIVE ORDER TO LOWER DAM HEIGHT).
For primary bibliographic entry see Field 06E.
W71-02184

MILLER V PERKINS (OBSTRUCTION OF SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02186

MELANDER V FREEBORN COUNTY (DAMAGES TO LAND AND CROPS AS A RESULT OF DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-02188

MATTER OF FORD (COMPENSATION FOR DEPRESSED LAND VALUES WHERE REDUCED WATER SUPPLY UPSET RIVER'S ECOLOGY).
For primary bibliographic entry see Field 06E.
W71-02190

THOMPSON V WATER RESOURCES COMM'N (JUDICIAL REVIEW OF DREDGING PERMIT).
For primary bibliographic entry see Field 06E.
W71-02191

HOLYOKE WATER POWER CO V WHITING AND CO (UNAUTHORIZED USE OF WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-02193

BELKUS V CITY OF BROCKTON (LIABILITY FOR FLOOD DAMAGE FROM BLOCKED STREAM).
For primary bibliographic entry see Field 06E.
W71-02194

TILLSON V CRANE BROOK CO (LIABILITY FOR THE NEGLIGENT LOWERING OF WATER LEVELS).
For primary bibliographic entry see Field 06E.
W71-02198

YASKILL V THIBAULT (LIABILITY OF LOWER RIPARIAN OWNER FOR BLOCKING STREAM).
For primary bibliographic entry see Field 06E.
W71-02199

4B. Groundwater Management

ARTIFICIAL GROUNDWATER RECHARGE THROUGH BASINS IN THE TEXAS HIGH PLAINS,
Agriculture Research Service, Bushland, Tex.
Donald C. Signor, and Victor L. Hauser.
Texas A and M University, Texas Agricultural Experiment Station, Miscellaneous Publication 895, September 1968. 8 p, 2 tab, 8 fig, 17 ref.

Descriptors: *Water management (Applied), *Artificial recharge, *Groundwater recharge, *Pit recharge, *Water conservation, Infiltration, Water spreading, Playas, Permeability, Perched water, Evaporation, Economic feasibility, Texas, Arid lands, Water loss, Sands, Clays, Particle size, Soil profiles, Hydraulic conductivity, Water levels, Piezometers, Hydrogeology, Nuclear meters.
Identifiers: *Recharge basin construction, *Texas High Plains, *Groundwater depletion, Runoff use.

Groundwater supplies in the 22.4-million acre Texas High Plains are being depleted by irrigation pumping. Artificial groundwater recharge is a means of managing water collected in playas. A recharge basin 120 by 240 feet was excavated in a

Bushland playa by removing clay to expose a 3 to 4-foot-thick sand. About 89 percent of the clear well water placed in the recharge basin infiltrated. The final loss rate from the basin was 0.06 inch per hour. This low rate resulted from a perched water table. The data indicated that a low infiltration rate, sustained over a large area, could recharge most of the runoff collecting in a playa. Geophysical, geological, particle-size distribution, hydraulic conductivity (double-tube permeameter method), stage-area, stage-volume and sub-basin hydrologic data are considered. Tables of soil texture and hydraulic conductivity, and figures showing geologic profile, aerial view of the basin and instrumentation, geohydrologic section, water loss and water levels versus time, elevation head versus depth, and neutron meter moisture determinations are presented. (Popkin-Arizona)
W71-01719

HYDROGEOLOGIC DATA FOR THE LOWER THAMES AND SOUTHEASTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02F.
W71-01816

SEPARATION OF OIL AND WATER WITH GRAVITY SEPARATOR (FRENCH),
Laval Univ., Quebec; and Hydraulic Research Inst., Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W71-01930

REMOVAL OF SALINE WATER FROM AQUIFERS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 05G.
W71-01932

QUANTITY OF WATER FLOWING INTO CIRCULAR INFILTRATION GALLERY,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
For primary bibliographic entry see Field 02G.
W71-01933

STUDY OF GROUNDWATER MOUNDS UNDER SPREADING AREAS,
Indian Inst. of Tech. (Bombay).
J. T. Panikar, and A. L. Mathur.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 232-234, 1969. 3 p, 2 fig.

Descriptors: *Artificial recharge, *Water spreading, *Mathematical models, *Hydraulic models, Capillary action, Hydraulic similitude, Water levels, Water table, Groundwater movement, Sands, Infiltration.
Identifiers: Boussinesq equation.

Artificial recharge of groundwater basins through water spreading was studied by analytical and analog analyses of the mechanism of mound formation, spacing of drains to restrict water table rise, and use of strip recharging. The analytical approach essentially consists in solving the Boussinesq equation of unsteady state, for given boundary conditions. The general character of the mound was found to be the same by both theoretical and experimental methods. Sand models have a great drawback in that capillary rise introduces serious errors. Dissipating mounds cannot be studied on sand models. The viscous flow model is a powerful tool to investigate the problems of groundwater movement with a free surface. (Knapp-USGS)
W71-01936

PUMPING FROM A SHALLOW WATER AQUIFER IN A COASTAL REGION,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 02L.
W71-01944

THE LINEAR AND NON-LINEAR REGIMES OF THE FILTRATION LAW AND THEIR CONSEQUENCES IN GEOHYDRAULIC PROBLEMS,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02F.
W71-01948

LONG ISLAND WATER RESOURCES.
New York State Office of Planning Coordination, Albany.
For primary bibliographic entry see Field 06D.
W71-01988

4C. Effects on Water of Man's Non-Water Activities

CONTINUED EVALUATION OF ROADSIDE DEVELOPMENT AND EROSION CONTROL EXPERIMENTS. PART I. CAUSES AND CONTROL OF SOIL EROSION ON OKLAHOMA HIGHWAYS. PART II. MAINTENANCE OF VEGETATIVE GROUND COVERS ON OKLAHOMA HIGHWAYS. PART III. WEED CONTROL AND ERADICATION ON OKLAHOMA HIGHWAYS,
Oklahoma Agricultural Experiment Station, Stillwater.
Wayne W. Huffine, and Lester W. Reed.
Available from NTIS as PB-189 907, $3.00 in paper copy, $0.95 in microfiche. n.d. Oklahoma HPR-1 (5). 73 p.
Identifiers: *Roads, *Erosion, *Soil mechanics, Roads, Plants (Botany), Grasses, Maintainability, Herbicides, Fertilizers, Effectiveness, Oklahoma, Weed control.

This report records the findings of a one-year extension of a study for which a final report in three parts was completed in 1968. The extension made it possible for the researchers to make additional observations and measurements of experimental plots established for the first study. Recommendations are listed to hasten more effective implementation of the study results. Basically, the data reported is used to reiterate and reemphasize the need to improve vegetation mangement practices for better erosion control, greater thrift and density of ground covers, and more effective control and eradication of weed species.
W71-01681

URBAN HYDROLOGY,
Bauer Engineering, Inc., Chicago, Ill.
W. J. Bauer.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 605-637, published by Univ of Illinois, 1969. 33 p, 3 fig, 3 tab.

Descriptors: *International Hydrological Decade, Conferences, *Urbanization, *Storm runoff, *Rainfall-runoff relationships, Research and development, Mathematical models, Flood routing, Cost-benefit analysis, Water resources development, Forecasting, Hydrology, Hydraulics, Flood control, Water quality control, Engineering, Planning, Projects, Research facilities, Water storage, Computers, Instrumentation.
Identifiers: *Water resources research, *Urban hydrology.

This paper presents viewpoints of a practicing consulting engineer concerning the following aspects of urban hydrology: the controlling economic factors; the need for improved analytical and design techniques; and the use of simplified methods pending the gathering of data required for the use of improved techniques. The northeastern Illinois metropolitan area is used as an example in illustrating each of these aspects. Storm runoff in urban areas takes up valuable space, and only the location of this space is subject to engineering control. Therefore it is the volume of runoff more than the rate of runoff which is important to evaluate for design purposes. Runoff from urban areas presents a quality control problem. Therefore it behooves the planner to move in the direction of large storage and small rates of flow, because of the high cost of treatment at high rates of flow for short periods of time. All methods of analysis of storm runoff and the associated flow in open channels involve the use of mathematical models. Every decision regarding storm drainage, even one to do nothing, involves an allocation of space for the temporary storage of storm water, and therefore involves an acceptance of the cost associated with that decision. (Knapp-USGS)
W71-01822

A SUMMARY OF THE HOPKINS STORM DRAINAGE RESEARCH PROJECT: ITS OBJECTIVES, ITS ACCOMPLISHMENTS, AND ITS RELATION TO FUTURE PROBLEMS IN URBAN HYDROLOGY,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
John C. Schaake, Jr.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 638-665, published by Univ of Illinois, 1969. 28 p, 8 fig, 12 ref.

Descriptors: *International Hydrological Decade, Conferences, *Urbanization, *Rainfall-runoff relationships, *Routing, Research and development, Rational formula, Cities, Engineering, Education, Gages, Water resources development, Forecasting, Hydrology, Hydraulics, Stream gages, Storm runoff, Planning, Projects, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Urban hydrology.

Since its initiation in 1949, the Hopkins Storm Drainage Research Project had the following primary objectives: Development of the principles of hydraulic behavior of storm water inlets and the practical application of these principles to storm water inlet design practice; development of instruments for measuring and recording rainfall and storm runoff and the systematic collection of rainfall-runoff data; and development of the relationship between rainfall and runoff and application to storm sewer design practice. During the period 1949 to 1967, 52 locations were gaged. Some of these involved only a rainfall measurement, but 40 locations involved both rainfall and runoff gages. Some of the gaged catchments were sewered, but 29 of them were inlet areas. A computer model of the rainfall-runoff process was developed to predict runoff more accurately than any other method; it is based on sound physical principles, and runoff data are not required for its application. (Knapp-USGS)
W71-01823

EROSION CONTROL ON HIGHWAY RIGHTS-OF-WAY IN ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
For primary bibliographic entry see Field 02J.
W71-02051

BASIC CONTEMPORARY URBAN PROBLEMS,
Illinois State Div. of Highways, Springfield.
For primary bibliographic entry see Field 06B.
W71-02144

BURKE V SOUTHERN BELL TEL AND TEL CO (LIABILITY OF UTILITY COMPANY FOR OBSTRUCTION OF RIVER).
For primary bibliographic entry see Field 06E.
W71-02161

UNITED STATES V NORFOLK-BERKLEY BRIDGE CORP (LIABILITY OF BRIDGE COMPANY FOR OBSTRUCTING NAVIGATION).
For primary bibliographic entry see Field 06E.
W71-02163

STATE EX REL LANDIS V ROSENTHAL (EXCLUSIVE FRANCHISE FOR BRIDGE OPERATION).
For primary bibliographic entry see Field 06E.
W71-02168

FLORIDA EAST COAST RY V ACHESON (LIABILITY FOR OBSTRUCTION TO NAVIGATION).
For primary bibliographic entry see Field 06E.
W71-02171

FLAMBEAU RIVER LUMBER CO V GETTLE (RIGHT OF LUMBER COMPANY TO HAVE RIVER NAVIGABLE FOR DRIVING LOGS).
For primary bibliographic entry see Field 06E.
W71-02178

4D. Watershed Protection

HEARINGS AND REPORT ON AMENDMENT TO THE WATERSHED AND FLOOD PREVENTION ACT BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONG, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01751

AN EVALUATION OF STREAMFLOW TIMING FROM SMALL WATERSHED IN NORTHEASTERN UNITED STATES,
Pennsylvania State Univ., University Park. School of Forest Resources; and Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02E.
W71-01917

CALIBRATION ANALYSIS OF THE THREE LEADING RIDGE EXPERIMENTAL WATERSHEDS,
Pennsylvania State Univ., University Park. Dept. of Forestry and Wildlife.
For primary bibliographic entry see Field 02E.
W71-01918

DESIGN OF A HYDROLOGIC CONDITION SURVEY USING FACTOR ANALYSIS.

Research Paper No 5, Tennessee Valley Authority, Division of Water Control Planning, Knoxville, Nov 1965. 25 p, 1 fig, 18 tab, 3 append, 15 ref.

Descriptors: *Design, *Streamflow, *Hydrologic data, *Resource development, *Land use, *Analytical techniques, Watersheds, Runoff.
Identifiers: *Factor analysis, Variables.

This paper described one step of a TVA project to develop relations between streamflow and land use that could be used in resource development plans. The step showed the development of a land-use survey form that will be used in future inventories. A technique used, termed Area-Stream Factor Correlation (ASFAC), was derived from the hypothesis that variations in streamflow response from watersheds can be explained only by a systematic description of the area. The fundamental step was relating analytically derived stream factors to measured factors such as soils, land use, slopes, erosion, and management which control the volume of runoff that occurs at the runoff source areas. The survey data was taken from the Bradshaw Creek-Elk River pilot study and soil samples were taken to determine the proportionate content of sand, silt and clay. In addition, the upper Bear Creek Watershed was surveyed in considerable detail on both open-land and forested plots. Forty-four different variables were ultimately defined and measured in the various forest surveys. Hydrologic condition survey information from seven different geographic areas was analyzed and a brief description of each area was given. Initial screening of the survey data was taken before initiating factor analysis. Factor loadings which are an expression of the contribution of each factor in explaining the variables were determined. Reasons for retaining or deleting each variable were explained. (Kriss-Cornell)
W71-02085

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PLAQUING AND IMMUNOLOGICAL METHODS FOR DETECTION AND IDENTIFICATION OF ENTEROVIRUSES,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
Peter P. Ludovici, Rosella Riggin, and Marion L. Moore.
Available from NTIS as PB-195 824, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, Water Resources Research Center, October 1970. 41 p, 8 tab, 43 ref. OWRR Project A-015-ARIZ (1).

Descriptors: *Waste water treatment, *Bacteria, *Membrane processes, Pollutant identification, *Viruses, Microbiology, Entric bacteria.
Identifiers: *Enterovirus, Bacteria removal, Membrane filtration, Plaquing, Poliovirus, Coxsackle B2, Echovirus, Plastic Panel Micro Culture.

In preliminary studies primary human amnion (HAM) plaqued with echovirus 13 but not with the other prototypes. Follow up studies showed that different amnions varied in their ability to form plaques with echoviruses. In detailed studies using suspended agar and monolayer agar overlay procedures, neither primary nor secondary HAM cultures produced plaques with any of the viruses. Hep-2 plaqued poliovirus 1 but not echovirus 13 or Coxsackie B2. Wi38 plaqued poliovirus 1 and echovirus 13 but not Coxsackie B2. The monolayer agar overlay procedure was superior to the suspended cell agar method because fewer cells were required. When Wi38 was used to detect natural viruses, concentrates from sewage yielded no plaques in 5 samples whereas 4 of the 5 concentrates were virus-positive by CPE in fluid cultures. One of two virus-positive concentrates from secondary treated wastewater gave 2 plaques per flask with Wi38. A plastic panel culture neutralization test was compared with the test tube method for the identification of viruses isolated from waste water. Only one out of the eight viruses studied was different being identified as type 3 polio by the standard test and type 2 polio by the panel method. (Ludovici-Arizona)
W71-01651

SURVEY TO DETERMINE QUANTITIES AND PROPERTIES OF SEWAGE FROM NAVAL VESSELS,
Marine Engineering Laboratory, Annapolis, Md.
For primary bibliographic entry see Field 05B.
W71-01690

SEEPAGE OF FEEDYARD RUNOFF WATER IMPOUNDED IN PLAYAS,
Southwestern Great Plains Research Center, Bushland, Tex.
O. R. Lehman, B. A. Stewart, and A. C. Mathers.
Texas A and M University, Texas Agricultural Experiment Station, Miscellaneous Publication 944, February 1970. 7 p, 5 tab, 3 fig, 5 ref.

Descriptors: *Water pollution sources, *Water quality control, *Seepage, *Soil contamination, *Water pollution, Agricultural watersheds, Impounded waters, Lagoons, Playas, Water storage, Natural recharge, Nitrates, Chlorides, Texas, Arid lands, Data collections, Sampling, Soil texture, Waste water (Pollution), Fine-textured soils.
Identifiers: *Groundwater pollution, *Agricultural pollution, *Feedyard runoff, Solute-soil reactions, Runoff control, Texas High Plains.

The Southern High Plains is experiencing rapid growth in cattle feedyards. Feedyard runoff waters contain large amounts of undesirable wastes. Playas act as natural lagoons and are being used to impound most of the surface runoff from feedlot watersheds. Playas can be grouped according to predominate soil texture. The 250-acre study playa near Amarillo is representative of fine-textured playas. It drains 3,700 acres and contains 1,250-acre feet of water when full. Runoff from storms and the adjacent 30,000-cattle feedyard was impounded. Soil samples were later taken from it and from a nearby, feedyard-runoff free playa. Analyses were made for a nitrite, nitrate, ammonium, chloride and water content. The data suggest that little or no deep nitrate seepage will occur through the bottom of fine-texture playas that receive feedyarcd runoff, though high chloride accumulations may be found. Tables show chemical and moisture analyses with depth at different sites of the feedyard and non-feedyard playas. Figures include soil texture map, aerial view of the study feedyard and playa and cross section of relative elevations of soil sampling sites. (Popkin-Arizona)
W71-01705

GAUGING AND SAMPLING INDUSTRIAL WASTE WATER (OPEN CHANNEL),
Department of Water Resources, New York. Bureau of Water Pollution Control.
Larry A. Klein, and Albert Montague.
Journal, Water Pollution Control Federation, Vol 42, No 8, Part I, p 1468-1475, August 1970. 13 fig, 4 ref.

Descriptors: *Monitoring, *Industrial wastes, *Open channel flow, *Sampling, Weirs, Flumes, Costs, Sewers.
Identifiers: *Gauging, V-notch weirs, Sampling devices.

Techniques and experiences in the gauging and sampling of open-channel flow as developed and used in controlling industrial waste discharges in New York City are described. These procedures were developed as a result of the imposition of sewer surcharges which are based on the volume and concentration of industrial wastes. Two primary methods are used: internal and external plant installations. Inplant gauging and sampling are accomplished by combining sporadic flows at an outlet using an inflatable gas bag and a portable ejection system. Variations in induatrial waste discharge practices are discussed and sampling devices and methods for the various conditions are described. Out-of-plant gauging and sampling employs three basic devices: a V-notch weir or Lagoflume in conjunction with a continuous-lead measuring device and a propeller meter with a submersible flow tube for a conversion to full-pipe flow. Advantages and disadvantages of each are discussed. It is concluded that with excercise of proper judgement these devices and techniques should adequately measure and sample the great majority of industrial waste discharges encountered in any municipality. (Sorber-Texas)
W71-01757

TRITIUM HYDROLOGY OF THE TALLAHASSEE, FLORIDA AREA WITH ANALYSIS BY LIQUID SCINTILLATION COUNTING WITHOUT ISOTROPIC ENRICHMENT,
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W71-01777

POTOMAC RIVER WATER QUALITY, WASHINGTON, D.C. METROPOLITAN AREA.
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Technical Services.
For primary bibliographic entry see Field 05B.
W71-01817

DIVISION OF ISOTOPES DEVELOPMENT RESEARCH AND DEVELOPMENT PROJECTS: 1969.
Division of Isotopes Development (AEC), Washington, D.C.

Available from NTIS as TID-25372, $3.00 in paper copy, $0.95 in microfiche. Progress Report, Feb 1970. 166 p.
Identifiers: *Radioactive isotopes, Research, *Radioisotope heat sources, *Labeled substances, *Water pollution, *Air pollution, Labeled substances, *Irradiated foods, *Radioactivation analysis, *Concrete polymer composities, *Radiation polymerization, Oil slicks.

A 1969 summary of the objectives, progress, results, and future plans for each of the research and development projects of the AEC Division of Isotopes is presented. The projects are separated into the following categories: radioisotopes production and materials; thermal applications development; uses in environmental and ocean sciences; radiation analysis and control; process radiation; radiation preservation of foods; and information services related to radioisotopes uses.
W71-01881

RESEARCH ON THE MARINE FOOD CHAIN. PROGRESS REPORT, JULY 1968-JUNE 1969, VOLUME 1. CHEMISTRY AND MICROBIOLOGY,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
John D. H. Strickland.
Available from NTIS as UCSD-10-P-20-52, $3.00 in paper copy, $0.95 in microfiche. IMR Report No. 69-9, 1969. 265 p. Contract AT (11-1)-Gen-10.
Identifiers: *Sea water, Chemical analysis, *Microbiology, Sea water, Temperature, Light, Marine biology, *Food chains.

Chemical investigations included determination of stable carbon isotopes in dissolved organic matter of the sea; micro-determination of uronic acids and related compounds in the marine environment; influence of temperature and solar radiation on vitamin B12, thiamine, and biotin in seawater, 13C: 12C ratios in dissolved and particulate organic matter in the sea; ecology of plankton in relation to vitamins; and determination of ammonia in natural waters. Microbiological studies included nitrification by marine bacteria in low concentrations of substrate and oxygen; cultural characteristics of a pelagic marine ciliate; determination of microbial biomass in ocean profiles; observations on continuous culture of a planktonic phagotrophic protozoan; and observations on heterotrophic activity in the eastern tropical Pacific.
W71-01885

THE APPLICATION OF PHASE SELECTIVE ALTERNATING CURRENT POLAROGRAPHY TO THE ANALYSIS OF HEAVY METALS IN WATER,
Georgia Inst. of Tech., Atlanta.
Robert Lon Poole, Jr.
PhD Thesis, Georgia Institute of Technology, August 1970. 73 p, 1 tab, 5 fig, 22 ref. OWRR Project A-020-GA (2).

Descriptors: *Chemical analysis, *Polarographic analysis, *Heavy metals, Inorganic components, *Metals, Chemical wastes, Water pollution sources, Pollutant identification, Surfactants, *Water analysis, *Analytical techniques, Chromium, Cobalt, Copper, Iron, Manganese.
Identifiers: Antimony, Bismuth, Cadmium, Indium, Lead, Mercury, Nickel, Thallium, Tin, Vanadium, Zinc.

The application of phase selective ac polarography and square-wave polarography to the analysis of heavy metals in water was investigated. Although both techniques were found to be suitable for water analysis, the majority of the study deals with the ac polarographic method due to unforeseen difficulties encountered in the construction of the square-wave polarograph. However, square-wave polarography did prove to be more sensitive than ac polarography. The square-wave technique was found to be more suitable for the analysis of species that are irreversible polarographically. In studies involving the reversible cadmium reduction and the irreversible zinc reduction in 1 F potassium chloride, the zinc response was better, with respect to the cadmium response, using square-wave polarography than ac polarography. The theory of ac and conventional dc polarography is presented. In addition, advantages and disadvantages of ac and square-wave techniques as compared with conventional polarography are dealt with. It has been found that the sensitivity of the ac polarographic instrument is such that the following metal ions can be detected down to a lower limit of about 10 to the minus 6 formula weights per liter: Sb (III), Bi (III), Cd (II), Cu (II), In (III), Pb (II), Sn (II), Sn (IV), and Zn (II). In addition, Co (II), Ni (II), Mn (II), Tl (I), Fe (II), and Fe (III) can be analyzed down to a limit of approximately 10 to the minus 6 formula weights per liter. Rather unsatisfactory results were obtained for Cr (III) and V (V) which could only be detected down to about 10 to the minus 4 formula weights per liter and all attempts to work with Al (III) failed. The ac technique has proven to be very suitable for the analysis of multicomponent systems. A number of such systems is discussed; particular attention is paid to metals which are normally difficult to simultaneously determine polarographically. The presence of surfactants (surface-active substances) commonly interferes with the ac polarographic technique. The problems associated with various types of surfactants are presented. A standard procedure for the elimination of interferences caused by surfactants has been developed. The results obtained from the analysis of some natural and industrial samples are reported.
W71-01895

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W71-01900

COLORADO TROUT LAKE STUDIES,
Colorado Dept. of Natural Resources, Fort Collins.
For primary bibliographic entry see Field 02H.
W71-01989

RAPID ANALYTICAL METHODS FOR THE INVESTIGATION OF METALS AND INORGANIC RAW MATERIALS. XII. DETERMINATION OF TRACE AMOUNTS OF BERYLLIUM IN MINERAL WATERS AND MINERALS,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 02K.
W71-01990

PHYSICAL PROPERTIES OF ANIMAL MANURES ASSOCIATED WITH HANDLING,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 27-32. 5 tab, 8 fig, 11 ref.

Descriptors: *Physical properties, Bulk density, *Farm wastes, Liquid wastes, Particle size, *Poultry, *Cattle.
Identifiers: Volatile solids, Fixed solids, *Flowability, Freezing point, *Production.

This paper is concerned with various physical properties of chicken and dairy cow manure that have a relationship to handling. The properties are considered mainly from the standpoint of both fresh and diluted manure. The information reported was obtained from analysis concerned with the physical properties of animal manures and represents a summary of those properties which are specifically related to handling. These properties are: (a) basic physical composition, (b) particle density and bulk density, (c) production, (d) particle size and distribution, (e) dilution, (f) settling rate, (g) suspended and dissolved solids, (h) flowability, and (i) freezing point. (See also W71-01992). (Christenbury-Iowa State)
W71-01998

AMMONIA AND AMINES: COMPONENTS OF SWINE-BUILDING ODOR,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. R. Miner, and T. E. Hazen.
Transactions of the ASAE, Vol 12, No 6, 1969. 3 p.

Descriptors: *Farm wastes, *Hogs, *Odors, *Ammonia, Atmosphere, Anerobic digestion, Proteins, Amino acids, Isolation, Chemical properties, Density, Physical properties, Absorption, Chromatography.
Identifiers: *Amines, *Odor thresholds, Concentration, Boiling points, Dissociation constants, Detection, Animal chambers.

This paper represents another step in defining the atmosphere within the swine confinement building. Ammonia and the closely related amines are known to be produced during the decomposition of both animal and vegetable proteins. Research work involving gases over decomposing manure indicate amines, ammonia and sulfur containing compounds are probably important constituents of the swine odor. The paper outlines the formation of ammonia and amines, and gives threshold odor levels for them in air. Physical and chemical properties of the different amines are given as well as methods of isolation and detection. Experimental data was taken from two animal chambers which provided substantial control over environmental conditions. The measured concentrations of ammonia were less than the threshold odor levels, indicating one of two explanations must be true: (a) Ammonia is not an important component of the hog house odor or (b) the odor producers are additive in effect and ammonia can be perceived at concentrations below its threshold when combined with other odorous compounds. Chromatographic analysis was used for detection of the different amines. (White-Iowa State)
W71-02041

ISOLATION OF SALMONELLAE FROM RENDERED BY-PRODUCTS AND POULTRY LITTER CULTURED IN ENRICHMENT MEDIA INCUBATED AT ELEVATED TEMPERATURES,
Massachusetts Univ., Amherst. Dept. of Veterinary and Animal Sciences.
C. F. Smyser, G. H. Snoeyenbos, and Barbara McKie.
Avian Diseases, Vol 14, No 2, 1970, p 248-254. 6 tab, 13 ref. US Public Health Service Grant UI 00159-05.

Descriptors: *Poultry, *Salmonella, *Incubation, Farm wastes, Isolation, Temperature, Hydrogen ion concentration, Indicators.

Identifiers: *Enrichment media, Poultry litter, Rendered bynproducts, Plating medium.

Three enrichment media incubated at 42 plus or minus 1C were compared for isolating Salmonellae from rendered animal and marine by-products, and two of the media were compared for poultry litter. Salmonellae were recovered from 317 of the 755 rendered samples and from 203 of the 235 litter samples examined. Selenite brilliant-green sulfapyridiae (SBG sulfa), dulcitol selenite sulfapyridine (DSES), and tetrathionate brilliant-green (TBG) were equally effective. Each enrichment incubated at the elevated temperature was significantly more effective than TBG incubated at 37C for isolating salmonellae from fish meal. Essentially no difference was noted between brilliant-green (BG) agar and brilliant-green sulfadiazine (BGS) agar as a plating medium. The pH of the enrichment media at the termination of incubation could not be used as an indicator of the presence or absence of salmonellae. (White-Iowa State)
W71-02045

ENGINEERING EVALUATION OF VIRUS HAZARD IN WATER.
American Society of Civil Engineers. Sanitary Engineering Div.

In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA1, p 111-161, February 1970. 2 tab, 140 ref, 1 append.

Descriptors: *Viruses, *Water quality, *Diseases, Infection, Environmental sanitation, Sewage treatment, Water purification.
Identifiers: *Virus hazard.

The evaluation is presented in terms of 13 questions: what virus infections may be spread through water. How important is water in transmitting virus disease. Can the coliform index be applied to an evaluation of enteric viruses in water. What is the status of control of infectious hepatitis transmission by shellfish. What is the status of sampling and detection procedures for viruses. What risk is associated with use of sewage effluents for crop irrigation. Do birds or animals contribute health important viruses to water. Do enteric viruses multiply in water. How significant is the hazard resulting from recreational use of impounded sources of drinking water supply. How effective are water purification processes in removing viruses. The report concludes that while further study is desirable, existing technology and careful, vigilant plant operation can provide an acceptable level of protection for water users. (Davis-Chicago)
W71-02112

RESEARCH NEEDS ON THERMAL AND SEDIMENTARY POLLUTION IN TIDAL WATERS.
American Society of Civil Engineers, New York. Hydraulics Div.

Journal of the Hydraulics Division, ASCE, Vol 96, No HY7, Proc Paper 7426, p 1539-1548, July 1970. 7 ref.

Descriptors: *Hydraulics, *Sedimentation, *Temperature, *Tidewater, *Water pollution, Estuaries, Instrumentation.
Identifiers: Sediments, Research needs.

When recently requested to identify the most pressing research need in its field, the ASCE Tidal Hydraulics Committee quickly arrived at the consensus opinion that thermal and sedimentary pollution of tidal water bodies were the major problem in need of research in its respective field. Upon designation of this research need the Tidal Hydraulics Committee was directed to develop the topic further, identifying the nature of the problems and dividing the subject into several smaller specific investigations. Over a period of a year valuable ideas and suggestions have been obtained from all committee members. These have culminated in the following report. The report describes the nature of the sedimentary and thermal pollution problems in tidal water and includes a review of the literature and some related research. The report outlines general and specific research needs in both thermal and sedimentary pollution and includes a section on instrumentation. (Preckwinkle-Chicago)
W71-02149

5B. Sources of Pollution

BYRAM V LAWEIN (DISCHARGE OF SEWAGE WATER ONTO ANOTHER'S LAND).
For primary bibliographic entry see Field 06E.
W71-01667

SURVEY TO DETERMINE QUANTITIES AND PROPERTIES OF SEWAGE FROM NAVAL VESSELS,
Marine Engineering Laboratory, Annapolis, Md.
K. Jacobson, and M. J. Posner.
Available from NTIS as AD-455 401, $3.00 in paper copy, $0.95 in microfiche. MEL-346/64 Report, January 1965. 13 p, 4 tab, 1 ref.
Identifiers: *Harbors, *Sewage, *Ships, *Wastes (Sanitary engineering), Bacteria, Rivers, Naval vessels (Combatant), Concentration (Chemistry).

A shipboard survey to determine the quantities of human wastes produced per capita and the physical, biological, bacteriological and chemical properties was conducted to establish the degree of pollution of harbor waters by naval vessels and provide design criteria for a treatment system. The data show that between 10 and 20 GPD of sewage are produced per capita on ships following a normal workday routine. A maximum of twice this amount can be expected of the operation is on an around-the-clock basis. The sewage produced contains an average of 236 mg/l of suspended solids and an average biochemical oxygen demand (BOD) of 102 ppm. The gometric average coliform density index was found to be 4.8 x 10 to the 5th. Data are also presented for the concentration of settleable solids, total solids and volatile solids present. The pH of the sewage and the dissolved oxygen present and the concentration of nitrogen present in various forms were determined. The survey also showed that the water in the vicinity of a vessel from which sewage is being discharged is not polluted to any adverse degree in terms of the commonly used parameters. Virtually no suspended solids were found in the river water and the coliform density was within the range permitted at most bathing beaches in the United States.
W71-01690

VILLAGE OF ORRVILLE V GOCHNAUER (MEASURE OF DAMAGES FOR STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W71-01691

SEEPAGE OF FEEDYARD RUNOFF WATER IMPOUNDED IN PLAYAS,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 05A.
W71-01705

CONTROL OF WILD CANE IN SOYBEANS,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W71-01713

WESTERN WHORLED MILKWEED AND ITS CONTROL,
Agricultural Research Service, Lincoln, Nebr. Crops Research Div.
For primary bibliographic entry see Field 03F.
W71-01715

LOSS OF HERBICIDES IN RUNOFF WATER,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
D. W. Trichell, H. L. Morton, and M. G. Merkle.
Weed Science, Vol 16, No 4, October 1968, p 447-449. 2 tab, 5 ref.

Descriptors: *Herbicides, *Runoff, *Weed control, *Brush control, *Plant growth regulators, 2-4-5-T, Arid lands, Simulated rainfall, Rates of application, Slopes, Surface waters.
Identifiers: *Herbicide efficiency, *Farm chemicals, *Dicamba, *Picloram, Plots.

The movement of farm chemicals via surface water has received increasing attention in the past decade. This study presents results from experiments conducted to determine the amount of herbicide in the runoff from small plots following simulated rainfall. The loss of 2-methoxy-3, 6-dichlorobenzoic acid (dicamba), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and 4-amino-3,5,6-trichloropicolinic acid (picloram in runoff water was determined 24 hours after gas chromatograph and bioassays. When determined 24 hours after application, dicamba and picloram losses were greater from sod plots than from fallow plots, while 2,4,5-T losses were equal. Four months after application, herbicide losses averaged less than 1 percent of that lost 24 hours after application. The amount of picloram lost in a simulated rainfall of 0.5 inch varied with rate, but the percentage lost was the same. The percentage of picloram lost was influenced by slope of the plot and movement over untreated soil. The maximum loss obtained for any herbicide was 5.5 percent and the average was 3 percent. Tables show effect of slope, application rate, movement over untreated soil, and herbicide concentration in runoff water. (Popkin-Arizona)
W71-01716

NORTH-EAST COAL CO V HAYES (LIABILITY FOR DAMAGES TO FARM BY COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01733

DIFFUSION OF HORIZONTAL BUOYANT JET DISCHARGED AT WATER SURFACE,
Tokyo Univ. (Japan).
Nobuyuki Tamai.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3, (Subject C), Science Council of Japan, Kyoto, p 215-222, 1969. 8 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Jets, *Mixing, *Convection, *Turbulence, Diffusion, Heated water, Thermal pollution, Path of pollutants, Waste water disposal, Mathematical studies.
Identifiers: Free turbulent jets.

The mixing process of a two-dimensional horizontal warm-water jet was studied by extension of free turbulent jet theory to cases of flow with fluid density differences. The variation of the mean velocity of the discharged jet and variation of the thickness of the buoyant jet region can be predicted fairly well with the assumption of similarity of velocity and density distributions in the diffusion region. The proposed analysis may be applied in principle to the discharge of cooling water from power plants and to sewage disposal in the marine environment. (Knapp-USGS)
W71-01790

LABORATORY INVESTIGATION OF THE TURBULENT DIFFUSION IN OPEN CHANNEL BY MEANS OF SALT WATER INJECTION,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
Soo Hahn Ahn.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C),

Science Council of Japan, Kyoto, p 343-352, 1969. 10 p, 8 fig, 7 ref.

Descriptors: *Path of pollutants, *Streams, *Waste disposal, *Mixing, Outlets, Turbulent flow, Turbulence, Dispersion, Diffusion, Tracers, Hydraulic models, Model studies, Flumes.
Identifiers: Turbulent diffusion, Korea.

When sewage effluent is discharged laterally into a river, the pollutant is transported not only to the longitudinal direction but also transversely by turbulence. The concentration distribution of pollutants in open channel was studied by means of salt water-injection in a flume model. The lateral concentration of salt follows the error curve. The rate of decrease of concentration along the side wall is commonly divided into three distinct zones. (Knapp-USGS)
W71-01809

POTOMAC RIVER WATER QUALITY, WASHINGTON, D.C. METROPOLITAN AREA.
Federal Water Pollution Control Administration, Cincinnati, Ohio. Div. of Technical Services.

Federal Water Pollution Control Administration Report, 1969. 80 p, 17 fig, 25 tab, append.

Descriptors: *Water pollution control, *Sewage treatment, *District of Columbia, Estuaries, Rivers, Water pollution sources, Virginia, Maryland, Standards, Pollution abatement.
Identifiers: *Potomac River.

This report reviews the status of water quality in the Potomac River estuary approximately one decade after a Federal Enforcement Conference was conducted on pollution of interstate waters of the Potomac River in the Washington metropolitan area. Six of nine major sewage treatment plants met recommendations that 80% BOD removal be accomplished. The District of Columbia (71.2%), Alexandria, Virginia (76.2%), and Fairfax County, Virginia's Westgate Plant (49.8%) failed. These three plants currently account for 94% of the BOD load discharged to the Potomac River. Effective disinfection of treated discharges was not accomplished. The District has made commendable progress in control of raw sewage discharges, but the recommended schedule of completion by 1966 was not met. Control of 39.6% of the raw sewage discharge has been accomplished and another 38.3% is now scheduled for control by 1969. Separation of the combined storm and sanitary sewers in progress that accounted for 22.1% of the total discharge is not scheduled for completion before the year 2000. Despite the advances, the Potomac River Estuary in the Washington metropolitan area remains grossly polluted due to inadequate sewage treatment, the rapid population growth, and the discharge of combined sewer overflows and raw sewage. Extremely high densities of bacteria from sewage are a threat to the health of all those who come in contact with the water of the river. (Knapp-USGS)
W71-01817

MICROBIAL DEGRADATION OF ORGANIC POLLUTANTS OF INDUSTRIAL ORIGIN,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05C.
W71-01898

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
John J. Fisher.
Available from NTIS as PB-195 976, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, Rhode Island Water Resources Center, 1970. 14 p. OWRR Project A-031-RI(1).

Descriptors: *Estuarine, *Photographic system, *Remote sensing, *Aerial photography, Water pollution sources, Pollutant identification.
Identifiers: *Infrared.

Multispectral aerial photographic remote sensing analysis was made of water quality in estuarine areas. Photographic interpretation was compared with 'ground-truth' data. Four film emulsions proved most efficient; panchromatic, black and white infrared, color and color infrared. A simple inexpensive four camera system using these films was designed and developed for this study. (Fisher-Rhode Island)
W71-01900

NATURAL OIL SEEPAGE AT COAL OIL POINT, SANTA BARBARA, CALIFORNIA,
General Research Corp., Santa Barbara, Calif., and California Univ., Santa Barbara. Dept. of Chemical Engineering.
Alan A. Allen, Roger S. Schlueter, and Paul G. Mikolaj.
Science, Vol 170, No 3961, p 974-977, November 1970. 4 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Water pollution sources, *Oil, *Seepage, *Reservoir leakage, *Geologic control, Oil-water interfaces, Coasts, Beaches, Fractures (Geology), Path of pollutants, Ocean currents.
Identifiers: *Oil seepage (Natural), Santa Barbara Channel (Calif), Oil slicks.

Periodic references have been made in the past to natural submarine oil seeps in the Santa Barbara Channel, but this paper reports for the first time realistic estimates of surface pollution resulting from oil seeps at Coal Oil Point, California. The area is generally believed to be the most prolific natural seep of the many oil seeps in the Santa Barbara Channel. Aerial, surface, and underwater investigations reveal that the Coal Oil Point seeps discharge 50 to 70 barrels (8,000 to 11,000 liters) of oil per day into the Channel. The resulting slicks are several hundred meters wide, and tarry masses within these slicks frequently wash ashore. The predominant offshore currents in the area usually prevent oil from fouling the water and beaches, however, and the extent of natural seepage goes unnoticed by most people along the coast. (Lang-USGS)
W71-01904

STREAM DISPERSION AT SELECTED SITES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W71-01914

SEPARATION OF OIL AND WATER WITH GRAVITY SEPARATOR (FRENCH),
Laval Univ., Quebec; and Hydraulic Research Inst., Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W71-01930

NICHOLS V FERNALD (UNREASONABLE USE OF FIRST RIGHTS IN SPRING).
For primary bibliographic entry see Field 06E.
W71-01953

DUCK-PROCESSING WASTE,
Robert S. Kerr Water Research Center, Ada, Okla.
Grover L. Morris.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 15-18. 6 tab, 6 ref.

Descriptors: *Farm wastes, *Poultry, *Coliforms, Biochemical oxygen demand, Chemical analysis.
Identifiers: *Evisceration, Long Islands ducks, Waste loads.

Objectives of the study were (a) to measure and evaluate duck processing plant waste loads and (b) to observe plant operations for possible reduction in total water use by redistribution or by reuse of certain waters presently discharged to waste after one use, or by a combination of redistribution and reuse. Study of two duck-processing plants located on Long Island provides data pertaining to water use, waste loads, and general operation. The finished product is a high-quality duck of considerable delicacy. Water use in duck-processing plants seems high when compared with water used in chicken processing. Means of reducing the amount of water used are discussed. (See also W71-01992). (Christenbury-Iowa State)
W71-01994

STORMWATER RUNOFF FROM CATTLE FEEDLOTS,
Kansas State Univ., Manhattan.
J. R. Miner, L. R. Fina, J. W. Funk, R. I. Lipper, and G. H. Larson.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 23-27. 8 tab, 9 fig, 11 ref.

Descriptors: *Water pollution, *Detention reservoirs, *Farm waste, Waste storage, Nitrogen compounds, Organic waste, Rainfall intensity, Coliforms, Streptococcus, Chemical oxygen demand, Bacteria.
Identifiers: Rainfall duration, Feedlot runoff, Bacteriological activity, Kjeldahl nitrogen, Pollution potential.

Runoff characteristics from two experimental cattle feedlots were studied. Runoff was high-strength organic waste containing large quantities of nitrogenous compounds. The nitrogenous matter was being transformed continuously by bacteriological activity. More organic matter and Kjeldahl nitrogen were found in the runoff (a) with low-intensity rainfall, (b) with moist conditions preceding rainfall, and (c) during warm weather. Cattle feedlot runoff was a concentrated source of bacteria that normally are used to characterize water quality. Hydrologic characteristics of feedlot waste contribute to their stream-pollution potential. A detention pond seems feasible to prevent some of the slugging nature of the material. Diverting all rainfall not falling directly on the feedlot surface around the entire facility and maintaining lots so their litter remains as dry as possible were helpful in minimizing stream pollution potential. (See also W71-01992). (Christenbury-Iowa State)
W71-01997

FERTILIZERS AND FEEDLOTS --- WHAT ROLE IN GROUNDWATER POLLUTION.

Agricultural Research, Vol 18, No 6, December 1969, p 14-15.

Descriptors: *Farm wastes, *Soil contamination, *Fertilizers, *Nitrates, Water pollution, Nitrogen, Nitrites, Aquifers, Colorado, Denitrification, Water table, Percolation.
Identifiers: *Feedlots, South Platte River Valley.

No significant contamination of the water table with nitrate from farm fertilizers or extensive cattle feeding operations was found in preliminary ARS studies in northeastern Colorado. But studies indicated that substantial amounts of nitrate could eventually reach the water table under heavily fertilized irrigated fields and under feedlots. ARS soil scientists measured nitrates in 129 soil cores drilled to bedrock or the water table and in 75 samples of groundwater taken with the cores in Colorado's South Platte River Valley. The investigators found that, on the average, the kind of land use did not effect the nitrate concentration of water entering the bottom of the holes where the cores were taken. The surface may contain more pollutants than water deeper in the aquifer. (White-Iowa State)
W71-02036

MODELING FEEDLOT RUNOFF POLLUTION,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering; and Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. R. Miner, R. I. Lipper, and L. E. Erickson.
Transactions of the ASAE, Vol 10, No 4, p 497-501, 1967. 5 tab, 8 fig, 7 ref.

Descriptors: *Farm wastes, *Runoff, *Chemical oxygen demand, *Model-studies, Cattle, Water pollution, Hydraulic models, Discharge, Depression storage, Hydrographs, Hydrology, Rainfall intensity, Simulated rainfall.
Identifiers: *Feedlot, *Stirred tank with injection model, Concentration, Nonsurfaced lot, Concrete-surfaced lot, Soil cover complex number.

Most emphasis of this paper was on quality aspects of feedlot runoff; however a brief discussion of possible hydraulic models is given. Three concentration models are described and their ability to predict feedlot runoff water quality is shown. The three are, the stirred tank concentration model, stirred tank with injection concentration model, and the series-stirred tanks with injection concentration model. The three concentration models provided progressively better data representation as their complexity increased. Two experimental cattle feedlots especially designed for runoff investigation were used in the study. Associated with the feedlots were rainfall simulation and measuring equipment, and runoff measuring and proportional sampling facilities. One lot was concrete surfaced, the other had concrete only around feed bunks. Tempered by good judgement, feedlot models can be used to help predict organic concentration of runoff from a feedlot. When an improved hydraulic model is developed, it can be combined with either of the single, stirred tanks to provide a single feedlot model to predict overall water-pollution potential. (White-Iowa State)
W71-02040

EFFECTS OF FEED CONSUMPTION ON BIOCHEMICAL OXYGEN DEMAND OF STEER EXCRETA,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
K. C. Mills, B. F. Parker, and I. J. Ross.
Transactions of the ASAE, Vol 12, No 1, 1969, p 133. 2 ref.

Descriptors: *Farm wastes, *Cattle, *Biochemical oxygen demand, Feeds, Silage, Grains, Pastures, Oxidation, Aerobic treatment, Sampling, Testing.
Identifiers: *Feed composition, Steers, Alsterberg modification, Winkler method.

The objective of the study on which the paper is based was to determine some of the effects of animal-feed composition of the rate of aerobic breakdown of animal waste. If differences in rate of aerobic breakdown occur because of feed composition, these differences should be proven by conducting biochemical oxygen demand tests on the wastes from animals on different feed. Thus excreta for BOD tests were obtained from three groups of steers being fed on all grain, grain and silage, and on pasture. The data for the pasture had much greater variability from week to week. Data on all tests are available in the original thesis and ASAE paper No. 67-930. It was concluded that the composition of animal feed will change the biochemical oxygen demand of animal excreta. This fact should be considered when designing aerobic systems for treating animal wastes. (White-Iowa State)
W71-02044

FARM WASTE DISPOSAL-AMENITY AND GOOD NEIGHBOURLINESS,
For primary bibliographic entry see Field 05E.
W71-02048

THERMAL POLLUTION CONTROL IN BAVARIA,
Bavarian Bureau of Water Supply and Pollution Control, Munich (West Germany).
For primary bibliographic entry see Field 05G.
W71-02071

MASONITE CORP V HILL (POLLUTION VICTIM MUST PROVE CERTAIN POLLUTANT CAUSED INJURY).
For primary bibliographic entry see Field 06E.
W71-02092

DAVIS V GARDEN HILLS CORP (PROPER MEASURE OF DAMAGES FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02093

KERBY V PRAIRIE PIPE LINE CO (INJURY TO CATTLE CAUSED BY OIL POLLUTION OF WATER).
For primary bibliographic entry see Field 06E.
W71-02128

THE COLOMBO (FEDERAL STATUTE PROHIBITING POLLUTION OF NEW YORK CITY HARBOR).
For primary bibliographic entry see Field 06E.
W71-02189

YASKILL V THIBAULT (LIABILITY OF LOWER RIPARIAN OWNER FOR BLOCKING STREAM).
For primary bibliographic entry see Field 06E.
W71-02199

5C. Effects of Pollution

QUANITATIVE DISTRIBUTION OF BENTHIC MACROFAUNA IN THE BLACK SEA,
Naval Oceanographic Office, Washington, D.C.
V. N. Nikitin.
Trans. of Trudy Inst. Okeanol., Vol. 69, p 285-329, 1964. Available from NTIS as AD-704 667, $3.00 in paper copy, $0.95 in microfiche. Naval Oceanographic Office Trans 461, 1969. 57 p.
Identifiers: *Ocean bottom, *Ecology, *Black Sea, *Marine biology, Distribution, Quantitative analysis, Population, Aquatic animals, Plants (Botany), Ocean bottom sampling, USSR, Translations, *Benthos.

The paper gives a comparative estimate for density of population and biomass of bottom macrofauna in different biocoenoses for separate regions of the Black Sea. Total benthos biomass has been calculated for all the eight vast regions of the sea which characterizes the 'productivity' level of these regions. The most productive regions appeared to be the northwestern part of the sea and in the sea region, adjoining the Roumanian coast. High productivity of the above regions results from the great volume of continental flow carrying large quantities of nutrients. For the entire life zone of the sea bottom, the total biomass of macrofauna (fish excepted) amounts to about 32,000,000 t. The average biomass of the benthic macrofauna for the entire sea will reach 305g/sq m.
W71-01683

VILLAGE OF ORRVILLE V GOCHNAUER (MEASURE OF DAMAGES FOR STREAM POLLUTION).
For primary bibliographic entry see Field 06E.
W71-01691

NORTH-EAST COAL CO V HAYES (LIABILITY FOR DAMAGES TO FARM BY COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01733

COASTAL/ESTUARINE POLLUTION, AN ANNOTATED BIBLIOGRAPHY,
Ocean Engineering Information Service, La Jolla, Calif.
Evelyn Sinha.
Ocean Engineering Information Series, Vol 3, 1970. 87 p, 2 index.

Descriptors: *Abstracts, *Coasts, *Estuarine environment, *Water pollution, *Bibliographies, Publications, Water resources, Water management (Applied), Estuaries, Oceans, Bays, Coastal marshes.

This bibliography, intended as a guide in interdisciplinary studies of pollution in the coastal zone, contains 631 informative abstracts of literature providing substantial scientific and technological information on: the detection, identification, measurement and analysis of parameters of pollution and pollutants; sources of pollution; coastal and estuarine processes; effects of pollution; water quality management and waste heat utilization. A bibliography of bibliographies, separate identification of theses, books, patents, and detailed subject and author indexes are included. Represented are sources found in 111 journals, some 32 national and international conferences and symposia, governmental research and development reports, institutional studies and industrial contract reports. Coverage includes 1965 to May 1970. (Woodard-USGS)
W71-01788

DEMONSTRATION OF TOXIC SUBSTANCES BY USING THE FISH, LEBISTES RETICULATUS (DUTCH),
Utrecht Rijksuniversiteit (Netherlands).
Jan F. Reith, R. H. Frost, C. A. Schrijver, and R. J. A. M. Albers.
Pharmieutisch Weekblad 104, No 14, p 273-287, 1969. 9 tab, 26 ref.

Descriptors: *Dieldrin, *Bioassay, Age, *Toxicity, DDT, Carbamates pesticides, Phenolic pesticides, Lethal limit, Evaluation, Water pollution effects.
Identifiers: Guppies, *Lebistes reticulatus, Age differences, Sensitivity, *Toxic symptoms, Lindane, Chlordane, Phosphate esters, Sevin, Mercury compounds, Cadmium chloride.

Comparison of the effect of dieldrin on the sensitivity of 2 groups of L. reticulatus showed that 3-day-old guppies were more sensitive than 21-day-old guppies. The tests were carried out in 1-l. beakers contg. a previously reported British medium (1966). Five to 6 guppies were acclimatized at 23 for 45 min. in these beakers after which the toxic substance in 1 ml. acetone was added. The animals were observed for toxic symptons and the number of dead animals was recorded after 6 and 24 hours. The reproducibility of the results was good, although differences were observed between different generations and also between guppies from other sources. This est is esp. useful for testing pesticides (i.e. DDT, lindane, chlordane), while good results were obtained with phosphate esters, Sevin, carbamates, tetramethylthiuram disulfide and hg compounds. Other compounds toxic to guppies included: Cdcl2, phenothiazine, phenacetin strychnine, and others. Testing of the material was done after isolation of the toxic material from organs, stomach contents, and excreta. Some pesticides may cause 100% death in a conc. of 0.01 mg/l., and others only between 0.1 and 1 mg/l. Other toxic compds., (nonpesticides), such as medicines, may have a lethal effect between 3 and 10 mg/l. In many cases this test is less sensitive than the one with Drosophila melanogaster. (Katz-Washington)
W71-01859

STUDIES ON THE ACTION OF HIGH CONCENTRATIONS OF ALKYLPOLYGLCYCOL ETHERS ON FISH (GERMAN),
Ch. Gloxhuber, and W. K. Fisher.
Fd Cosmet. Toxicol. Vol 6, p 469-477, 1968. 10 fig, 24 ref.

Descriptors: Water pollution effects, *Detergents, Surface tension, Fishkill, *Toxicity, *Fish physiology, Fish behavior, Bioassay, Lethal limit, *Animal pathology, Mode of action.

Identifiers: *Alkylpolyglycol ethers, Nonionic detergents, Anionic detergents, *Histology.

In solutions of lethal concentrations of alkylpolyglycol ethers, belonging to the group of nonionic detergents, fish exhibit a picture of intoxication different from that in lethal solutions of anionic detergents. The reduction in the surface tension of the water seems to be the basic cause of the poisoning of fish by anionic detergents. The studies have shown that this largely applies also to the alkylpolyglycol ethers, but while the action of anionic detergents is limited to the gills, alkylpolyglycol ethers pass through the gills and are absorbed. The course of the intoxication resulting from action on the gills corresponds to that following absorption through the peritoneal cavity. The symptoms of poisoning after absorption of alkylpolyglycol ethers show a marked similarity to those due to detracaine and procaine, the type and course of the narcotic symptoms being like those already known to local anaesthetics. (Katz-Washington)
W71-01860

INTERACTION OF ANTIMYCIN A AND ROTENONE IN FISH BIOASSAYS,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Robert M. Howland.
The Progressive Fish-Culturist, Vol 31, No 1, p 33-34, 1969. 1 tab, 4 ref.

Descriptors: *Antimycin A, *Rotenone, Fish control agents, Rainbow trout, Sunfishes, *Bioassay, Toxicity, Fish management, Lethal limit, Compatibility, Rehabilitation, Water pollution effects.
Identifiers: *Interactions, LC50.

Bioassays utilizing rainbow trout and bluegill sunfish were conducted with Antimycin A, rotenone, and a combination of rotenone and antimycin A to determine whether interaction does occur, and, if so, whether it intensifies or nullifies toxicity. The toxic effect of antimycin A is manifested more slowly than that of rotenone. The combination of antimycin A and rotenone is more toxic than either alone. No nullifying interaction occurs upon admixture. For Antimycin A, rotenone, and the combination of 96 hour LC50's for rainbow trout are 0.032 ppb, 57.0 ppb, and 0.027 ppb Antimycin A and 31 ppb Rotenone, respectively. For bluegills these values are 0.157 ppb, 114 ppb, and 0.112 ppb Antimycin A and ppb rotenone. (Katz-Washington)
W71-01862

TOXICITY OF RHODAMINE B AND FLUOREXCEIN SODIUM TO FISH AND THEIR COMBATABILITY WITH ANTIMYCIN A,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Leif L. Marking.
The Progressive Fish-Culturist, Vol 31, No 3, p 139-142, 1969. 2 tab, 10 ref.

Descriptors: *Compatibility, *Antimycin A, *Bioassay, *Toxicity, Dye releases, Evaluation, Rainbow trout, Channel catfish, Sunfishes, Fish toxins, Fish control agents, Lethal limit, Water pollution effects.
Identifiers: *Rhodamine B, *Fluorescein sodium, Fluorescent organic dyes, LC50, Interactions.

Bioassay using rainbow trout, channel catfish, and bluegill were conducted with rhodamine B, fluorescein sodium and mixtures of these dyes with antimycin A were conducted. The 96-hour LC50 of Rhodamine B to rainbow trout, channel catfish, and bluegill is 217 ppm, 526 ppm and 379 ppm respectively. For fluorescein sodium these values are 1,372 ppm, 2, 267 ppm, and 3, 433 ppm. The data indicate that less antimycin is required to kill rainbow trout when it is combined with 100 ppm of rhodamine B. Similarly, less antimycin is required to kill catfish when it is combined with 5 ppm of rhodamine B. In contrast, more antimycin is required to kill bluegills when combined with 5 ppm of fluorescein. No conclusive reasons are given for these differences. The author feels that both dyes are relatively non-toxic to fish. (Katz-Washington)
W71-01863

THERMAL TOLERANCE OF JUVENILE SALMON IN RELATION TO NITROGEN SUPERSATURATION,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
Wesley Ebel, Earl M. Dawley, and Bruce Monk.
Report, September 1970. 28 p, 5 tab, 7 fig, 11 ref, append.

Descriptors: *Nitrogen gas, *Thermal tolerance, *Salmon, Juvenile fish, Water pollution effects, Mortality, Laboratory equipment, History, Thermal pollution.
Identifiers: *Super saturation, *Oncorhynchus kisutch, *O. tschawhytscha, and *Salmo gairdneri.

Described are the results of experiments designed to determine the effect of supersaturation of nitrogen gas on thermal tolerance of 3 species (Oncorhynchus kisutch, O. tschawhytscha, and Salmo gairdneri) of juvenile salmonids. The data indicated that tolerance of all 3 species at all acclimation temperatures was lowered and that LE50 rates were accelerated when supersaturation of nitrogen at 125-130 percent was present in the test water. Increasing the depth of the test tanks allowed the fish to compensate somewhat for the supersaturation by sounding, but substantial mortalities still occured. Tests revealed that coho were the most tolerant, chinook next, and steelhead the least tolerant to temperature increases in the presence of supersaturation of nitrogen. (Wahtola-Washington)
W71-01864

INTERACTING EFFECTS OF GAMMA RADIATION AND SODIUM HALIDE CONCENTRATIONS ON RAINBOW TROUT,
Utah State Univ., Logan. Center of Ecology.
John M. Nouhold, and R. K. Sharma.
Symposium on Radioecology, Proceedings of the Second National Symposium on Radioecology, Ann Arbor, Michigan, p 142-151, May 15-17-1967. 3 tab, 9 fig, 15 ref. CONF-670503.

Descriptors: *Radiation (Gamma), *Sodium halides, *Rainbow trout, Mortality, Laboratory equipment, Water pollution effects.
Identifiers: *Interactions, *137Cs, Sodium fluoride, Sodium chloride, Sodium bromide, Sodium iodide.

The objective of the experiment was to investigate the effects of gamma ray doses and halide concentrations on rainbow trout survival, and to develop possible explanations for the patterns of mortality, that result from these interactions. Mortality of 137 Cs gamma irradiated rainbow trout subjected to aquarium medium levels of sodium fluoride, sodium chloride, sodium bromide and sodium iodide displayed significant response to either time by gamma dose, time by sodium halide concentration, of gamma dose by sodiumhalide concentration interactions. The interactions were concluded to be caused by radiation induced changes in oxygen uptake and sodium uptake and excretion. (Wahtola-Washington)
W71-01865

INFLUENCE OF DISSOLVED OXYGEN AND CARBON DIOXIDE ON SWIMMING PERFORMANCE OF LARGEMOUTH BASS AND COHO SALMON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Michael L. Dahlberg, Dean L. Shumway, and Peter Doudoroff.
Journal of the Fisheries Research Board of Canada, Vol 25, No 1, p 49-70, 1968. 2 tab, 6 fig, 26 ref. U.S. Public Health Service. Grant WP-00135.

Descriptors: *Dissolved oxygen, *Carbon dioxide, *Swimming performance, *Large mouth bass, *Coho salmon, Water temperature, Laboratory equipment, Length, Weight, Stream flow, Juvenile fish, Water pollution effects.
Identifiers: *Relationships, Physiology, Alkalinity.

The final swimming speed of juvenile largemouth bass, Micropterus salmoides was reduced markedly at oxygen concentrations below 6 or 6 mg/liter in tests at 25C. At levels about 6 mg/liter, the final swimming speed was virtually independent of the oxygen concentration. The performance of bass that had been acclimated overnight to elevated carbon dioxide levels was not materially affected by the highest tested concentrations of free carbon dioxide. For juvenile coho salmon, Oncorhynchus kisutch at temperatures near 20 C and carbon dioxide concentrations near 2 mg/liter, any considerable reduction of the oxygen concentration from about 9 mg/liter, the air-saturation level, resulted in some reduction of the final swimming speed. The performance of the salmon was impaired much more markedly than was that of the bass by the same reduction of the oxygen concentration. At oxygen concentrations near and above the air-saturation level, high concentrations of free carbon dioxide averaging 18 and 61 mg/liter had a depressing effect on the final swimming speed of coho salmon even after overnight acclimation. No measurable effect of free carbon dioxide concentration near 61 mg/liter was evident at 2 mg/liter dissolved oxygen, and concentrations near 18 mg/liter had little or no effect even at moderately reduced dissolved oxygen levels after overnight acclimation of the salmon to these carbon dioxide concentrations. (Wahtola-Washington)
W71-01866

INFLUENCE OF OXYGEN CONCENTRATION ON THE GROWTH OF JUVENILE LARGEMOUTH BASS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Nelson E. Stewart, Dean L. Shumway, and Peter Doudoroff.
Journal of the Fisheries Research Board of Canada, Vol 24, No 3, p 475-494, 1967. 3 tab, 4 fig, 16 ref. U.S. Public Health Service. Grant wp-00135.

Descriptors: *Dissolved oxygen concentration, *Growth rates, *Largemouth bass, Food conversion efficiency, Juvenile fish, Laboratory equipment, Temperature, Food consumption, Fluctuations, Water pollution effects.
Identifiers: *Interactions, Earthworms.

Several experiments are reported on the influence of nearly constant dissolved oxygen concentrations, both below and above the air-saturation level, and of wide diurnal fluctuations of oxygen concentration on the appetite, growth, and food conversion efficiency of juvenile largemouth bass, Micropterus salmoides. The fish were fed unrestricted rations of small, live earthworms throughout the six experiments, whose duration was usually 15 days. The growth rates and food consumption rates of the bass increased markedly with an increase of the constant oxygen concentrations to levels near the air-saturation level, and declined with further increase of oxygen concentrations. Gross food conversion efficiencies were considerably reduced only at concentrations well below 4 mg/liter. The growth of bass subjected alternately to low and higher oxygen concentrations for either equal or unequal portions of each 24-hr day was markedly impaired. It was almost always less than that which presumably would have occured had the fish been held at a constant concentration equal to the mean concentrations to which the fish had been exposed. (Wahtola-Washington)
W71-01867

THE USE OF COPPER SULFATE AS A MEDICAMENT FOR AQUARIUM FISHES AND AS AN ALGAECIDE IN MARINE MAMMAL WATER SYSTEMS,
California Academy of Sciences, San Francisco. Steinhart Aquarium.

Robert P. Dempster, and William H. Shipman.
Occasional Papers of the California Academy of Sciences, No 71, 1969. 6 p, 2 fig, 4 ref.

Descriptors: *Copper sulfate, Algicides, *Toxicity, *Aquaria, Fish management, Fish parasites, Chemcontrol, Resistance, *Fish diseases, Protozoa, Analytical techniques, Regression analysis, Epizootiology, Water pollution effects.
Identifiers: *Gill diseases, Therapy, Oodinium.

This paper describes the use of copper sulfate to control algae and fish ectoparasites in marine aquaria. The method introduced in this paper prevents copper precipitation in alkaline water, thus permitting copper ions to be maintained in-solution. Copper compounds must be utilized with considerable caution since they are toxic to all forms of life. Therefore, a technique is given by which, once the concentration of copper in the water system is adjusted, sequestered copper is added at a rate sufficient to maintain the concentration. This procedure has been used for the last 15 years at the Steinhart Aquarium, and as a result there has been no outbreak of fish disease. Copper concentrations up to 1 ppm have been used. (Katz-Washington)
W71-01868

LOBSTERS UNHARMED BY OIL POLLUTION.
Fisheries Research Board of Canada, St. Andrews (New Brunswick).

Fisheries of Canada, Vol 22, No 10, p 20, 1970.

Descriptors: Water pollution effects, Oily water, *Oil wastes, *Taste, *Lobsters, Emulsifiers, Public health.
Identifiers: *Oil pollution, Chedabucto Bay, Nova Scotia.

Tests have shown that oil pollution in Nova Scotia's Chedabucto Bay does not appear to be affecting lobsters. Simulated tests have included the coating of lobsters with bunker oil and feeding lobsters herring coated with oil. Taste test have indicated no tainting of lobster meat. Experiments carried out with oil dispersants also appeared not to have affected the lobsters. (Sjolseth-Washington)
W71-01869

BIOENVIRONMENTAL AND RADIOLOGICAL SAFETY FEASIBILITY STUDIES ATLANTIC-PACIFIC INTEROCEANIC CANAL. FINAL REPORT, TERRESTRIAL ECOLOGY,
Georgia Univ., Athens. Inst. of Ecology.
Frank B. Golley, John T. McGinnies, and Richard G. Clements.
Available from NTIS as BMI-171-24, $3.00 in paper copy, $0.95 in microfiche. Battelle Memorial Institute, May 29, 1969. 80 p. Contract AT (26-1)-171.
Identifiers: *Ecology, Nuclear explosion, *Radiological contamination, Terrain, *Inland waterways, Ecology, Feasibility studies, Inland waterways, *Nuclear excavation, Atlantic Pacific Interoceanic Canal.

In 1966, the University of Georgia, Institute of Ecology, contracted with Battelle Memorial Institute, Columbus, Ohio, to carry out studies in terrestrial ecology in Panama and Colombia. These were part of the bioenvironmental and radiological-safety feasibility studies for an Atlantic-Pacific interoceanic canal authorized under Public Law 88-609, 88th Congress. One objective of the overall study was to determine the best route for, and the feasibility of, constructing a sea-level canal between the Atlantic and Pacific Oceans by nuclear excavation. The objective of the University of Georgia, Terrestrial Ecology program, was to determine the movements of potential radionuclides produced by construction in the terrestrial ecosystems adjacent to the proposed canal routes. Analysis of the movement of radioisotopes through terrestrial ecosystems required information on the concentration and cycling of elements. Since radioactive tracers could not be used and present fallout levels in the ecosystems of interest were very low, it was necessary to follow the cycle of nonradioactive elements. The determination of stable-element cycling in the terrestrial ecosystems required information on the kinds of ecosystems, their biomass, and mineral standing crops. The ecosystems were conceived as a series of compartments: overstory leaves, overstory stems, understory leaves, understory stems, fruits and flowers, epiphytes, litter, roots, soil, herbivores, carnivores, and detritivores. Each compartment was visualized as having a capacity and inputs and outputs. The capacity was defined as the quantity of biomass and/or element contained within the compartment; transfer functions were calculated from the input and output rates. Sixty-three tables are presented to show results. (See also W71-01884)
W71-01883

BIOENVIRONMENTAL AND RADIOLOGICAL-SAFETY FEASIBILITY STUDIES: ATLANTIC-PACIFIC INTEROCEANIC CANAL. DARIEN FISH DIETARY,
Battelle Memorial Inst., Columbus, Ohio.
James A. Duke, and Ann W. Rudolph.
Available from NTIS as BMI-171-23, $3.00 in paper copy, $0.95 in microfiche. 13 June, 1969. 150 p. Contract AT (26-1)-171.
Identifiers: *Marine biology, *Ecology, *Panama, *Inland waterways, Atlantic ocean, Pacific ocean, Radiobiology, *Atlantic Pacific Interoceanic Canal.

A preliminary discussion is presented concerning kinds of freshwater and marine fish used as food by man, bait used for fishing, methods of fishing, and types of fish eaten at different seasons. The body burdens of 55Fe in people who eat Alaskan marine fish were found to be several times higher than those of caribou-eating eskimos. A brief review of the literature on food habits of fish is given, and there is a discussion of the role of fish in food chains and mixing of faunas. The importance of sea grass (Thalassia sp.) as food for fish and invertebrates is discussed. An extensive list of freshwater and marine fish found or expected in Panama and adjacent Colombia with notes on their uses and feeding habits is presented. Both scientific and common names are included. A bibliography of approximately 150 references is appended. (See also W71-01883)
W71-01884

MICROBIAL DEGRADATION OF ORGANIC POLLUTANTS OF INDUSTRIAL ORIGIN,
Massachusetts Univ., Amherst.
Haim B. Gunner.
Available from NTIS as PB-195 982, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, October 15,1970. 11 p, 11 ref. OWRR Project A-020-MASS (4).

Descriptors: *Diazinon, *Hydrolysis, *Rhizosphere effect, Organophorous, Compounds, Copper, *Microorganisms, *Biodegradation, Degradation (Decomposition), Water pollution sources, Organic pesticides, Industrial wastes, *Organophorous pesticides, Insecticides, Water pollution effects.
Identifiers: Microbial ecosystems, Organic pollutants.

The disappearance of Diazinon was compared in sterile and non-sterile water systems. Chemical hydrolysis was pH related. Kinetic studies showed the maximum hydrolysis rate at pH 3.5 with the minimum at neutrality. The presence of metals, particularly copper, enhanced hydrolysis. Maximum hydrolysis was achieved in the presence of native microflora and under natural systems. These are shown to be the primary agents in the degradation of the Diazinon molecule. Diazinon and its derivatives were found to effect a profound and sustained disequilibration in microbial ecosystems. The basis of this population selection was found to be the selective inhibition of susceptible populations by Diazinon in their dissimilation of a wide range of carbon substrates. Studies of population interactions between higher plants and microflora established that the rhizosphere effect hitherto reported only for terrestrial plants applies equally to an aquatic milieu. Studies with anaerobic microflora showed that Diazinon was nutritionally inaccessible as a carbon source and in addition was an inhibitory agent. The nature of inhibition was diffuse and appeared to result from a general disruption of the cell membrane. (Gunner-Mass)
W71-01898

BIOLOGICAL INTERRELATIONSHIPS BETWEEN FECES AND FLIES,
California Univ., Berkeley.
For primary bibliographic entry see Field 05D.
W71-01996

PROBLEMS OF CATTLE FEEDING IN ARIZONA AS RELATED TO ANIMAL-WASTE MANAGEMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05D.
W71-02027

SEA GRANT ACTIVITIES.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 09D.
W71-02054

THERMAL POLLUTION-BIOLOGICAL EFFECTS, A REVIEW OF THE LITERATURE OF 1969,
Water Pollution Control Federation, Washington, D.C.
Charles C. Coutant.
Journal of Water Pollution Control Federation, Vol 42, No 6, p 1025-1057, June 1970. 200 ref.

Descriptors: *Biological communities, *Thermal pollution, Temperature, Biogeography, Resistance, Reproduction, Growth rates, Animal physiology, Animal diseases, On-site investigations, Bibliographies.
Identifiers: *Synergism, *Polymorphism.

This article reviews the literature of 1969 on the biological effects of thermal pollution. It sites a number of other reviews published during 1969 dealing with temperature effects in aquatic ecosystems, industrial thermal discharges, and subtle responses of organisms to temperature changes. The main topics covered are the biological problems associated with biogeography, synergism, resistance, reproduction, polymorphism, feeding, growth, temperature selection, physiology, disease, primary production, waste assimilation, and beneficial uses. Another topic covered briefly is on-site field studies of biological effects resulting from thermal discharges. (Osborne-Vanderbilt)
W71-02055

HEAT REJECTION REQUIREMENTS OF THE U. S.,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske, J. F. Fletcher, and K. R. Wise.
Chemical Engineering Progress, Vol 66, No 11, p 17-22, Nov 1970. 7 fig, 2 tab, 10 ref.

Descriptors: *Cooling water, *Thermal pollution, Environment, Optimization, Electric power, Forecasting, Cooling towers, Evaporation, Control.
Identifiers: Heat rejection, Thermal pollution, Environment, Optimization, Electric power, Forecasting, Cooling towers, Evaporation, Control.

Currently only 20% of total environmental heat loads originate from electrical production. Even conversion to a total electric automobile economy would cut the total energy release to the environment by a factor of two because at projected efficiency growths in the electrical industry 50% ther-

mal efficiency appears a barely achievable goal under current energy policies. By the year 2000 A.D., a 300% increase in total energy release is projected to occur over present values the incremental electric capacity of 1,060 gigawatts for the years 1970-2000 will require a consumptive flow of 31,200 cu ft/sec of water for evaporation alone which is about twice the flow of the entire Colorado River Basin. Simulation modeling is fully capable of predicting and evaluating thermal effects and without advance simulation, the decisions on plant size, level of treatment, treatment options, and plant location can be forced to produce built-in economic disadvantages (such as cooling towers) to the detriment of an already deteriorating rate structure. By use of appropriate tax incentives such as an energy depletion allowance, such wasteful energy consumers as the disposable container, the internal combustion automobile engine, uninsulated structures, incineration of wastes, an nonregenerative air-conditioning systems could be brought into some semblance of control. (Upadhyaya-Vanderbilt)
W71-02062

CHANGING EMPHASIS IN THE SITING OF STEAM ELECTRIC POWER STATIONS,
Oak Ridge National Lab., Tenn.
M. M. Yarosh.
American Society of Mechanical Engineers Winter Annual Meeting, New York, Nov 29-Dec 3, 1970. 8 p, 3 fig, 2 tab, 28 ref.

Descriptors: *Thermal pollution, *Cooling water, Sites, Electric power plants, Forecasting, Water, Aquatic environment, Population, Transmission lines, Costs, Legislation.
Identifiers: Sulfur oxides, Waste heat.

Over the next 30 years, total electric power consumption is projected to increase by about a factor of 5 or 6. Considering the economics the power plants should be located near the load center, should have an adequate fuel supply and adequate source of cooling water at acceptable temperature, and adequate land of suitable topography on which to site the powerplant is essential. Other considerations in siting are area economics, tax base and local citizen attitude towards the powerplant, etc. By 1990, it is estimated that there will be a total of approximately 300 fossil fuel plant sites and 200 nuclear plant sites of over 500 mw capacity. Heating of receiving water bodies reduces the maximum oxygen carrying capacity at the system while simultaneously increasing biological and biochemical oxygen demands within the system. Under current growth projections, the emission rates for sulfur oxides from electric power plants will rise from the 12 million tons per year in 1965 to over 100 million tons per year by the turn of the century. Over the next 20 years about 10,000 miles of 765-kv lines will be required, together with an additional 190,000 miles of other transmission lines. Underground power transmission lines are potentially more acceptable but cost 10 to 20 times more than conventional overhead transmission. Productive use of waste heat, advanced practices in siting and policies and new directions are also described in brief. (Upadhyaya-Vanderbilt)
W71-02063

THE EFFECT OF TEMPERATURE ON THE LIFE CYCLE, GROWTH AND FECUNDITY OF BRANCHIURA SOWERBYI (OLIGOCHAETA: TUBIFICIDAE),
Reading Univ. (England). Dept. of Zoology.
R. J. Aston.
Journal of Zoology, London, N. 154, p 29-40, 1968. 7 fig, 22 ref.

Descriptors: *Thermal pollution, Oligochaetes, Tubificids, Growth rates, Life cycles, Water temperature, Sexual maturity, Heated water.
Identifiers: River Avon, River Thames, Warmed habitats, Branchiura cocoon.

Branchiura sowerbyi Beddard was probably imported into Britain with tropical aquatic plants consigned to botanic gardens. The British populations occur mainly in artificially warmed habitats. Data on the temperature relations of Branchiura was collected from a life cycle study in the field from observations on the life cycle of worms in cultures reared in semi-field conditions and from laboratory experiments on the growth and fecundity of worms over a range of constant temperatures. The life cycle of Branchiura was completed in about a year at natural temperatures in the river Avon and in warm conditions in a power station effluent discharged into the river Thames. Cocoons were produced in spring and summer and most of the worms had attained sexual maturity by March of the following year. These worms probably died during the cocoon laying season. Laboratory experiments showed that the optimum temperature for cocoon production was 25C for both the Thames and Avon population. Growth in sexually mature worms was fastest at 10C in the Avon population and 15C in the Thames population but in immature worms growth was most rapid at about 30C. It followed that at high temperatures a high rate of cocoon production retarded growth in sexually mature worms. (Upadhyaya-Vanderbilt)
W71-02066

THE PRODUCTION OF ZOOPLANKTON IN SOUTHAMPTON WATER,
Southampton Univ. (England).
For primary bibliographic entry see Field 02L.
W71-02070

TEMPERATURE EFFECTS ON THE SORPTION OF RADIONUCLIDS BY FRESHWATER ALGAE,
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
R. S. Harvey.
Health Physics, Pergamon Press, Vol 19, Aug 1970, p 293-297. 4 fig, 3 tab, 7 ref.

Descriptors: Temperature, Sorption, Radioisotopes, Algae, Growth rates, Thermal pollution.
Identifiers: Savannah River Plant, Culture media, Dry weight, Thermal effects.

The species studied were collected from the reactor effluent streams at Savannah River Plant. Unialgal cultures were developed in inorganic media. All tests were conducted using the continuous flow culture system described by Watts and Harvey. Water temperatures of 23, 26, 29 and 32C had no significant effect on the sorption of 137Cs, 85Sr, 65Zn, 59Fe, 57Co and 54Mn by the filamentous green alga Stigeoclonium lubricum. Radionuclide concentrations in the unicellular diatom Navicula seminulum were 2-5 times higher at 32C than those obtained at lower temperatures. Water temperatures of 25, 30, 35, 40C had no significant effect on the sorption of 137Cs, 85Sr, 65Zn and 59Fe by the filamentous blue-green alga Plectonema boryanum. However, 57Co concentrations in P. boryanum decreased with temperature, and 54Mn concentrations increased from 25 to 35C. Growth rates of N. seminulum and P. boryanum were inhibited at 32 and 25C, respectively. Growth of S. lubricum was not influenced by the temperatures tested. These data show that nonlethal changes in water temperature had no major influence on the sorption of essentiall elements by the algae studied. (Upadhyaya-Vanderbilt)
W71-02075

A PRELIMINARY EVALUATION OF THE THERMAL EFFECTS OF THE BEN FRANKLIN DAM PROJECT ON COLUMBIA RIVER TEMPERATURES BELOW THE HANFORD PLANT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske.
AEC Research and Development Report No BNWL-733, VC-2, April, 1968. 33 p, 21 fig, 3 tab, 10 ref. USAEC Contract AT (45-1)-1830.

Descriptors: *Thermal pollution, *Temperature, *Reservoirs, Density currents, Weather data, Model studies.
Identifiers: Hanford plant, Ben Franklin dam, Travel time, *Digital simulation, River profiles, *Temperature transient.

Using the Hanford plant operations record for the year 1966, and the weather record for the same period, a series of simulation runs was made to determine the effects of the dam on the temperature regime, and the extent to which density currents could be expected to develop. This information is to be used as background for the later evaluation of the modification of the existing radionuclide discharge. The digital simulation model, colheat, was used. Operations with the model, using the data period indicated showed that the existence of the proposed project would have nominal effect, tending towards a slight increase in downstream temperature for both the 385 and 400-ft pool elevations. Under some conditions, in critical temperature seasons (April and September), plant operations cause amplification of about 10C maximum of the temperature transients associated with stream regulations and plant load factor. The 385-ft pool can be considered a channel flow case for estimating travel time. However, density currents could be expected in the 400-ft pool for most of the summer months, thus causing decreased travel time and relatively adiabatic thermal conditions for the main flow system at the lower end of the reservoir. (Upadhyaya-Vanderbilt)
W71-02076

MASONITE CORP V HILL (POLLUTION VICTIM MUST PROVE CERTAIN POLLUTANT CAUSED INJURY).
For primary bibliographic entry see Field 06E.
W71-02092

ENGINEERING EVALUATION OF VIRUS HAZARD IN WATER.
American Society of Civil Engineers. Sanitary Engineering Div.
For primary bibliographic entry see Field 05A.
W71-02112

KERBY V PRAIRIE PIPE LINE CO (INJURY TO CATTLE CAUSED BY OIL POLLUTION OF WATER).
For primary bibliographic entry see Field 06E.
W71-02128

CHAPTER IV: OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 06B.
W71-02134

5D. Waste Treatment Processes

PLAQUING AND IMMUNOLOGICAL METHODS FOR DETECTION AND IDENTIFICATION OF ENTEROVIRUSES,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
For primary bibliographic entry see Field 05A.
W71-01651

AREAWIDE SEWERAGE MASTER PLAN REPORT: PHASE I - INVENTORY SUMMARY REPORT.
Denver Regional Council of Governments, Colo.

Available from NTIS as PB-190 446, $3.00 in paper copy, $0.95 in microfiche. Summary Report, February 1970. 111 p, 5 tab, 8 fig. HUD Project Colo P-77.
Identifiers: *Urban planning, *Sewage, *Colorado, Urban planning, Inventory, Urban areas, Sanitary engineering, Tables, Diagrams, Maps, Population, Wastes (Industrial), Water supplies, Water pollution, *Denver (Colo).

This report summarizes an inventory of sewerage agencies and facilities in the Denver Metropolitan Area. Sewerage information is presented for four groups of agencies: the Metropolitan Denver Sewage Disposal District No. 1 and its members and connectors; other core area agencies; Englewood-Littleton and connectors; and Boulder area agencies. This report is the first report of a continuing areawide sewerage master plan study. Subsequent phases will include analysis of sewerage information and preparation of an areawide sewerage master plan.
W71-01679

AREAWIDE SEWERAGE MASTER PLAN REPORT FOR THE DENVER METROPOLITAN AREA. PHASE I (INVENTORY).
Denver Regional Council of Governments, Colo.

Available from NTIS as PB-191 197, $3.00 in paper copy, $0.95 in microfiche. Denver Regional Council of Governments, March 1970, various pagings. HUD Colorado Project P-77.
Identifiers: *Urban planning, *Colorado, *Sewage, Urban areas, Management planning, Public health, Control, Industries, Area planning and development, Sewers, Denver (Colo), Sewage treatment facilities, Public utilities.

The report summarizes an inventory of sewerage agencies and facilities in the Denver Metropolitan Area.
W71-01687

APPLICATION OF IONIZING RADIATION TO THE TREATMENT OF WASTE WATERS AND SEWAGE SLUDGE,
Gulf General Atomic, Inc., San Diego, Calif.
D. M. J. Compton, Sandra J. Black, F. L. Lieurance, and W. L. Whittemore.
Available from NTIS as GA-9632, $3.00 in paper copy, $0.95 in microfiche. GA-9632, August 8, 1969. 22 p, 48 ref. AEC Contract AT (04-3)-167.
Identifiers: *Waste water treatment, *Sewage treatment, *Dissolved organic matter, *Sewage, *Radiation chemistry, *Nuclear industrial applications, Sewage, Costs, Ionization.

Direct radiation oxidation of organic impurities in waste waters is not an economically competitive process, since the G values (number of single-electron-transfer oxidations per 100 e V of ionization energy deposited) measured are too low and since the oxidation process becomes ineffective at low concentrations of impurities. The use of irradiation as a conditioning agent in sludge filtration is also economically noncompetitive, since similar results can be obtained with small amounts of chemical conditioning agents, and since the conditioning produced by irradiation saturates at too low a value to be useful. Irradiation does produce potentially useful effects in enhancing the settling of sludge, but the effect is unpredictable. Further work on this topic is proceeding.
W71-01695

PLAN FOR PUBLIC SEWERAGE FACILITY DEVELOPMENT.
Rhode Island Statewide Comprehensive Transportation and Land Use Planning Program, Providence.

Available from the NTIS as PB-192 947, $3.00 in paper copy, $0.95 in microfiche. Report No 11, September 1969. 92 p, 10 tab, 13 fig.
Identifiers: *Urban planning, *Rhode Island, *Sanitary engineering, Urban planning, Economics, Water pollution, Management planning, Sewage, Costs, *Regional planning and development, *Sewers.

This report represents an effort to plan for the future development of sewerage facilities on a statewide basis in relation to the physical, economic and social development of the state. The plan sets forth the framework necessary to provide for the future development of sewerage facilities to promote the future growth and economic development of Rhode Island and the need to control and reduce the pollution of the state waterways. The planning period extends to the year 1990, beginning with a short range plan from the present to the year 1975, and a long range plan commencing in 1975 and covering the period to the year 1990. The major parts of the report include: (1) the role of the state in sewerage facility planning; (2) present extent of public sewerage systems in Rhode Island; (3) future sewerage system requirements; (4) statewide plan for the future development of sewerage facilities; (5) short range and long range plan cost estimates; and (6) implementation of the sewerage facility development plan.
W71-01700

DECARBONATION AND DEAERATION OF WATER BY USE OF SELECTIVE HOLLOW FIBERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Charles A. Cole, and Emil J. Genetelli.
Environmental Science and Technology, Vol 4, No 6, p 514-517, June 1970. 1 tab, 3 fig, 8 ref.

Descriptors: *Membrane processes, *Water reuse, *Deaeration, Dissolved oxygen, Permeability, Gases, Equations, Waste water treatment.
Identifiers: *Hollow fibers, *Pervaporation, *Decarbonation, Volatile pollutants.

Pervaporation or gas-liquid separation using selective membranes as a potential new unit operation for water and waste water treatment is discussed. Studies involving this process for decarbonation and deaeration are described. The basic separation theory is presented and further developed according to Fickian diffusion theory and Henry's Law. The bench-scale laboratory process consisted of feeding distilled water to which 500-700 mg/l carbonate (as CaCO3) was added through a bundle of 5000 hollow fibers (45r o d and 25r i d) constructed similarly to a tube heat exchanger. The separated CO2 and O2 were removed from the fiber surface by vacuum or nitrogen gas sweep. Effectiveness of the system was evaluated in light of CO2 concentration, temperature and fiber material. It was found that polypropylene fibers were most efficient and removed more than 96% of the dissolved oxygen and 99% of the alkalinity at feed concentrations of 7.6 mg/l and 250 mg/l (as CaCO3) respectively. It was estimated that these same results could be achieved in a flow of 10,000 gpd by using 7.7 cu ft of polypropylene separator at a 20 deg C operating temperature and a specific surface area of 9000 sq ft/cu ft. (Sorber-Texas)
W71-01756

GAUGING AND SAMPLING INDUSTRIAL WASTE WATER (OPEN CHANNEL),
Department of Water Resources, New York. Bureau of Water Pollution Control.
For primary bibliographic entry see Field 05A.
W71-01757

ANAEROBIC TREATMENT OF WASTES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Raymond C. Loehr.
Developments in Industrial Microbiology, Vol 9, p 160-174, 1968. 5 fig, 32 ref.

Descriptors: *Anaerobic digestion, *Anaerobic conditions, *Waste water treatment, *Organic loading, *Nutrient requirements, Organic waste.
Identifiers: *Solids retention time, *Temperature effects, *Buffer capacity, *Waste mixing.

Almost all naturally-occuring organic matter and many synthetic organic compounds can be fermented, or digested anaerobically and when carried out to completion, the main end products are methane and carbon dioxide. Anaerobic digestion is thought to occur in a series of steps, the two most important steps being the conversion of complex organics to simple organic material and the conversion of simple organics to gaseous end products, predominantly methane and carbon dioxide. The basic factors that should be evaluated when considering anaerobic waste treatment include: (1) mixing, (2) solids retention time, (3) availability of nutrients, (4) buffer capacity, (5) loading and (6) temperature. Solids retention time is of greater importance in anaerobic systems than in aerobic systems. The minimum solids retention time increases with decreasing temperature and has been estimated at 3-5 days for systems operating at 35 deg C and in the range of 15-20 days for systems operating at 15 deg C. There are four basic processes that can be employed for anaerobic waste treatment: (1) single stage, (2) two stage, (3) two stage with sludge return, and (4) the anaerobic filter. Each of these processes are discussed. Two stage with sludge return and the anaerobic filter are processes that can maintain high solids retention time values while permitting small unit volumes and high loading rates. This article also discussed anaerobic systems for solid wastes, including industrial and animal waste, for dilute organic waste, and for soluable organic waste. (Waid-Texas)
W71-01758

PERVAPORATION OF VOLATILE POLLUTANTS FROM WATER USING SELECTIVE HOLLOW FIBERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Charles A. Cole, and Emil J. Genetelli.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R290-R298, August 1970. 2 tab, 10 fig, 8 ref.

Descriptors: *Membrane processes, *Ammonia, *Waste water treatment, Water reuse, Permeability, Gases, Equations.
Identifiers: *Hollow fibers, *Pervaporation, *Volatile pollutants, Ammonia separation.

Studies involving pervaporation or gas-liquid separation using selective hollow fibers for the removal of ammonia from a water solution are described. Ammonia removal by this method was investigated as an alternative to sir stripping at elevated pH. It was found that nylon was more selective for removal of ammonia than was polypropylene or Dacron. The basic separation theory is presented and further developed as a result of this study according to Fickian diffusion and Henry's Law. The process used involves feeding synthetic ammonia water through a bundle of hollow fiber separators constructed similarly to a tube heat exchanger with the separated ammonia being removed from the fiber surface by vacuum or nitrogen gas sweep. Effectiveness of the system was evaluated in light of ammonia concentration, temperature, fiber material, pressure differential and alternate sweep materials. Under optimum conditions, it was found that a 90% removal of an initial ammonia concentraion of 50 mg/l in a 10,000 gpd stream would require a separator volume of 271 cu ft. assuming an operating temperature of 20 deg C, a nylon separator and 9,000 sq. ft./cu. ft. specific surface area. Although the process has been demonstrated to be feasible it appeared less promising than results of previous studies which indicated that 99% of an initial 250 mg/l alkalinity (as CaCO3) could be removed using 7.7 cu ft. of polypropylene separator under identical conditions. (Sorber-Texas)
W71-01759

FERMENTATION INDUSTRY-PHARMACEUTICAL, CORN, SUGAR, (LITERATURE REVIEW),
Oklahoma State Univ., Stillwater.
A. F. Gaudy, Jr.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1160-1162, June 1970. 11 ref.

Descriptors: *Waste water treatment, *Yeasts, *Biochemical oxygen demand, *Aerobic treatment, *Organic waste, Anaerobic digestion, Lagoons.
Identifiers: *Distillery waste.

The results of pilot-plant studies on aerobic biological treatment of a distillery waste was reported and aerated lagoons were selected as the method of treatment yielding an average BOD removal efficiency of 91.5%. Another report evaluated loading parameters for anaerobic digestion of distillery waste and concluded that higher organic loadings could be digested successfully when using diluted rather than raw (undiluted) waste water. The production of yeasts can both cause and help solve waste water problems. A report reviewed methods for handling waste water from yeast production, and the use of yeast for the treatment of wastes. It has proved effective in treatment of amino acids, leucine and glutamic acids, mono-, di-, and hydroxy-carboxylic acids. The effects of holding time and pH on the removal of BOD from a potato starch waste was reported. Longer holding times and an increase in pH in the range 4 to 9 provided greater BOD removals. A report discussed various tests for estimating organic matter in effluents and outlined a modified permanganate oxidation method applicable to sugar mill waste. An alternative procedure was given for wastes containing significant amounts of nitrogenous materials. The results were correlated with 5-day BOD values. (Waid-Texas)
W71-01760

MEAT AND POULTRY PROCESSING WASTES (LITERATURE REVIEW),
Battelle Memorial Inst., Columbus, Ohio.
John H. Litchfield.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1162-1165, June 1970. 12 ref.

Descriptors: *Poultry, *Waste water treatment, *Aerobic treatment, *Organic waste, Biochemical oxygen demand, Aeration, Anaerobic digestion, Lagoons, Heat treatment.
Identifiers: *Slaughterhouse waste treatment.

Several reports summarized waste treatment methods for meat processing plants. They emphasized the necessity of assuring that pathogenic organisms were destroyed or inactivated during treatment processes so that they would not reach receiving streams. One report presented an evaluation of the treatment of hog slaughtering wastes using aerated and anaerobic lagoons. BOD, grease, and suspended solids removal in the total system were 69.0, 98.2, and 96.2% respectively. The use of heat treatment of slaughterhouse wastes for BOD reduction was investigated. Best BOD and total nitrogen reduction were achieved in the range of 100 deg to 120 deg C. Another treatment method using a series of stabilization ponds and an aeration pond was discussed. The recirculated material from the aeration pond was reported to be useful as a soil conditioner. Aerated ponds were also found to be suitable for treating poultry waste. The process reduced the BOD from 800 to 1000 mg/l in the influent to less than 30 mg/l in the final effluent. An extended aeration treatment system and a baffled oxidation pond system were both used for a combined chick hatchery, poultry processing plant, and by-products plant and the results were reported. A final report described an aerated lagoon system for treating mink food manufacturing waste, consisting of horse meat, ripe, frozen liver, fish, poultry scrap, cereal and water. BOD reduction of 90% was obtained with a construction cost of $114.50/lb BOD. (Waid-Texas)
W71-01761

EVALUATION OF FACILITY OPERATION (LITERATURE REVIEW),
Grand Rapids, Mich.
Doris M. Voshel.
Journal Water Pollution Control Federation, Vol 42, No 6, p 969-971, June 1970. 10 ref.

Descriptors: *Treatment facilities, *Waste water treatment, *Biological treatment, Cost efficiencies, Biochemical oxygen demand, Activated sludge, Suspended solids, Chlorination.

Descriptions of new facilities and improvement of exisiting facilities of several treatment plants were described. New surface aerators in Greece, New York treatment plant resulted in more efficient mixing and thus more oxygen transfer increasing overall BOD removal from 70.8% to 81.7% and suspended solids removal from 76.8% to 83.9%. The expanded secondary treatment plant at Beloit, Wisconsin employs a unique sludge press and oval concrete aeration tanks providing a high performance second-stage purification facility and a proving grounds for a new concept in treatment equipment. Welland, Ontario completed an ultra-modern pollution control plant with an average capacity of 8 mgd and peak design flow of 20 mgd. The cost of the treatment facility was $2.35 million and $5.5 million for a new connecting trunk sewer system. The primary plant was designed to remove 95% grit, 70% setteable solids, and 30% BOD. The sludge is digested, thickened and vacuum filtered. The water pollution control plants of other cities were described giving removal efficiencies and costs. (Waid-Texas)
W71-01762

CONCENTRATION OF DILUTE PULPING WASTES BY REVERSE OSMOSIS AND ULTRA FILTRATION,
Institute of Paper Chemistry, Appleton, Wis.
Averill J. Wiley, George A. Dubey, J. M. Holderby, and A. C. F. Ammerlaan.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R279-R289. 3 fig, 3 tab, 6 ref. FWQA Grant 12040 EEL.

Descriptors: *Reverse osmosis, *Pilot plants, *Pulp and paper industry, *Water reuse, Pulp wastes, Biochemical oxygen demand, Chemical oxygen demand, Dissolved solids, Reynolds number, Color, Waste water treatment.
Identifiers: *Ultrafiltration, Membrane fouling, Membrane scaling, Inorganic ion, Velocity.

Pilot plant scale studies in the waste treatment capabilities of the reverse osmosis process for the concentration of dilute effluents of the pulp and paper industry are reported. Three demonstrations involving calcium sulfite, ammonia, sulfite and neutral sulfite wastes are discussed and the test results are analyzed. The pilot unit was designed to handle waste volumes of between 20,000 to 100,000 gpd under field conditions when operating at 600 psi with the prospect of the concentrate stream containing 7 to 10% solids. Average data indicated that the unit rejected more than 98% of color; 88 to 97% of inorganic primary pulping ions (Ca, Na, NH3); 87 to 95% of chemical oxygen demand and dissolved solids; and 70 to 88% of BOD. BOD rejection was found to be less for wastes containing low molecular weight organic volatiles. Operating problems including membrane fouling and sealing, membrane life and membrane flux regeneration are discussed. Cost estimates are provided for full-scale operations on the basis of these studies. (Sorber-Texas)
W71-01763

DISINFECTION (LITERATURE REVIEW),
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Riley N. Kinman, and H. A. Faber.
Journal Water Pollution Control Federation, Vol 42, No 6, p 949-952, June 1970. 22 ref.

Descriptors: *Chlorination, *Disinfection, *Chlorine, *Radiation, Waste water treatment, *Disinfection.
Identifiers: Bromine, Rapid sand filtration.

Several reports have discussed the various chlorine-providing compounds utilized for disinfection of waste water. The characteristics and costs of each were discussed and it was found that equal results might be obtained in waste water disinfection with either chlorine or the kypochlorites. The effects of chlorine on algae and different viruses were presented. Complete algae kill was caused by 10 mg/l chlorine at 2 hour contact. A combined chlorine residual of 40 mg/l (measured amperometrically) provided 99.99 percent destruction of the type I poliovirus in settled waste water with 30 minutes contact time. The studies indicated that present chlorination practices (1 mg/l residual) were totally inadequate for a high level of virus inactivation. Several reports investigated the use of radiation for disinfection treatment of waste water. It was found that without synergistic effect, radiation disinfection cost using Cobalt 60 would be prohibitive for general waste water treatment. Different types of methods for disinfection of waste water were outlined including the use of bromine, chlorine-bromine, and iodine, as well as chlorine. One report studied the removal of nematodes by rapid sand filtration since present methods of disinfection (chlorination) seemed to have little effect on the distruction of nematodes. The predominant factor in determining the percent of nematode removal was the percent of motile nematodes in the influent regardless of sand size. (Waid-Texas)
W71-01764

WASTE TREATMENT BY AEROBIC TECHNIQUES,
Department of National Health and Welfare, Kingston (Ontario).
Peter M. Higgins.
Developments in Industrial Microbiology, Vol 9, 1968, p 146-159. 9 fig, 4 tab, 13 ref.

Descriptors: *Aerobic treatment, *Activated sludge, *Lagoons, *Trickling filters, *Sewage treatment, *Aeration, Anaerobic digestion, Cost, Sludge, Waste water treatment.
Identifiers: Dispersed growth, Modified activated sludge process, Extended aeration, Contact stabilization, Complete mixing.

In biological systems microorganisms continuously remove organic matter from liquid waste by synthesis into new protoplasm. The activated sludge process biologically degrades waste, through aeration into microbial mass. The active mass is separated in clarifiers then either discharged or recycled and the clear effluent is discharged to the receiving stream or given further treatment. Several basic activated sludge process variants: dispersed growth, high rate or modified, conventional, total, oxidation or extended aeration, contact stabilization and complete mixing are discussed. In trickling filters the removal of organic matter is accomplished by adsorption at the surface of biological slimes covering the filter media. The adsorbed organic compounds are hydrolized and utilized by the attached slimes for growth and energy. Variations of the trickling filters were described, including low rate, high rate and super rate filters. The third aerobic process discussed was lagoons in which aerobic conditions are produced by algae. It has been shown however that conventional ponds are actually 75% anaerobic at all times. (Waid-Texas)
W71-01765

PHYSICAL AND CHEMICAL METHODS (LITERATURE REVIEW),
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Jesse M. Cohen.
Journal Water Pollution Control Federation, Vol 42, No 6, p 971-983, June 1970. 88 ref.

Descriptors: *Reclaimed water, *Reclamation, *Tertiary treatment, Demineralization, Adsorption, Coagulation, Flocculation, Sedimentation, Flotation, Filtration, Ion exchange.
Identifiers: Phosphorus removal, Polymeric flocculants, Precipitating agents.

Reports were given discussing the use of physical-chemical processes in waste water treatment. Among the topics presented were water supply, water quality requirements, waste water treatment, and methods of sludge disposal. The reclaimed water was then utilized in a variety of applications in industry, i.e., cooling and irrigation. A variety of

chemical techniques for phosphorus removal was presented which included precipitation with aluminum, ferric salts, lime, sodium aluminate and polyelectrolytes. The advantages, disadvantages and costs of these techniques were given. Several pilot plant studies evaluated the carbon adsorption process and summarized a full-scale application. A report also described a laboratory-scale reactivation unit for powdered activated carbon. A variety of reports presented different aspects of the coagulation-flocculation process. The studies included the use of alum and lime as coagulants, the effect of particle size on turbidity removal, and the interactions of colloidal dispersions with electrolytes. The cost and effectiveness of synthetic flocculants were also evaluated. Sedimentation and flotation were the subject of several reports. The tube clarification process, microflotation techniques, foam separation of powdered activated carbon, and removal of Chlorella ellipsoidea from suspension were investigated and reported. (Waid-Texas)
W71-01766

WATER RECLAMATION AND REUSE (LITERATURE REVIEW),
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
Thomas M. Keinath.
Journal Water Pollution Control Federation, Vol 42, No 6, p 952-963, June 1970. 77 ref.

Descriptors: *Water reuse, *Reclaimed water, *Reclamation, Flotation, Filtration, Foam fractionation, Chloronation, Activated carbon, Diatomaceous earth, Electrodialysis, Reverse osmosis, Waste water treatment.
Identifiers: *Municipal waste water reclamation, *Industrial waste water reclamation, Ammonia stripping, Recarbonation-stabilization, Microstraining, Flash evaporization.

Because of the convergence of the diminishing supply of water and the expanding demands placed on that supply, the advanced-level treatment and reuse of waste water has gained increasing recognition as a keystone to total water resources management. Several reports discussed the concepts of water resource development including importation, conservation, total use, and reuse. Programs for municipal waste water reclamation of several cities were outlined including provisions for flotation, ammonia stripping, recarbonation-stabilization, sand filtration, foam fractionation, chlorination, and activated carbon filtration. General aspects of industrial waste water reclamation were discussed and treatment processes for a variety of different industries were outlined. More rigid requirements for waste water disposal have intensified the reuse of water and intensified the interest in various unit processes that might be utilized for renovating waste waters to meet effluent and/or reuse criteria. Several reports discussed in detail and gave cost information for various advanced-level unit operations. Included in these discussions were microstraining, diatomaceous earth filtration, dual-media filtration, adsorption on granular activated carbon, chemical oxidation, flash evaporation, electrodialysis, freezing, reverse osmosis, phosphate precipitation, and air-stripping of ammonia. Waste water reclamation by indirect cycle through irrigation and direct injection for groundwater recharge was also discussed. (Waid-Texas)
W71-01767

COAL AND COAL MINE DRAINAGE (LITERATURE REVIEW),
Bituminous Coal Research Inc., Monroeville, Pa.
James F. Boyer.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1179-1185, June 1970. 49 ref.

Descriptors: *Coal mine waste, *Coal mines, *Water pollution sources, *Water pollution treatment, *Acid mine water, Cost, Hydrologic aspects, Waste water treatment.
Identifiers: *Acid mine drainage, Strip mine lakes, Lime slurry, Mine drainage pollution control.

The Bituminous Coal Research, Inc. compiled a bibliography of abstracts which were published by the Pennsylvania Department of Mines and Mineral Industries. The most comprehensive report, prepared by the Appalachian Regional Commission gave an in-depth study of the sources, occurrences, control techniques and impact on public facilities of acid mine drainage in Appalachia. The report estimated a cost of $6.6 billion for mine drainage pollution control and abatement. Several other reports documented the effect of mine drainage on water quality and groundwater in smaller geographic areas. The formation of acid mine drainage including all reaction from the oxidation of pyrite to the subsequent release of acidity, was the subject of several reports. The reports indicated that pyrite is rapidly oxidized by ferric ions, and oxygen was necessary only for the oxidation of ferrous ions which is a slower reaction and thus the rate determining step. Reports discussing the treatment of acid mine drainage indicated processes using a lime slurry or limestone proved to be the most economic and practical. Reports involving special treatment problems were also presented. They included high ferrous iron content mine water treatment, use of inert gases to eliminate acid pollution from abandoned deep mines and the effectiveness of mine drainage pollution control measures, as applied at an abandoned mine site. (Waid-Texas)
W71-01768

WASTE WATER AND STORM FLOW TREATMENT (LITERATURE REVIEW),
D. J. Weiner.
Journal Water Pollution Control Federation, Vol 42, No 6, p 963-969, June 1970. 42 ref.

Descriptors: *Waste disposal, *Sewerage, *Sewers, *Overflow, *Municipal waste, Waste water treatment.
Identifiers: Sewerage systems, Stormwater, Storm sewers.

The role of waste water transportation, control, and treatment was being reemphasized as part of the requirements in improved control and improvement of the environment. New communities have demanded sewerage services and older municipalities expanded sewage facilities into new areas as they found that residents expected to receive adequate sewage services. Sewers continue in importance as an economical and efficient means of waste disposal. Several reports presented various aspects and problems connected with different types of pipes for sewage use. These included clay pipes, concrete pipes, asbestos concrete pipes and PVC pipes. Maintenance programs and safety programs were described in several papers. Also presented were construction programs incorporating pipe testing and root control methods for new and renovated sewers. The control and treatment of overflows from combined sewers have attracted attention and interest of several papers as the total water pollution control program grows. Regulation and treatment of overflows have been investigated in the United States and other countries. A variety of programs in several cities for treatment of the combined sewer overflows were discussed. (Waid-Texas)
W71-01769

CONTROL MECHANISMS OPERATIVE IN A NATURAL MICROBIAL POPULATION SELECTION FOR IT'S ABILITY TO DEGRADE L-LYSINE,
Oklahoma State Univ., Stillwater. Bioengineering Labs.
C. P. L. Grady, Jr., A. F. Gaudy, Jr., and Elizabeth T. Gaudy.
Applied Microbiology, Vol 18, No 5, p 776-784, November 1969. 5 fig, 2 tab, 21 ref. FWPCA Grant WP-00786.

Descriptors: *Microorganisms, *Bacteria, *Control, *Maintenance, *Growth rate, *Chemical oxygen demand, Inhibition, Enzymes, Waste water treatment.
Identifiers: *Induction, *Repression, *Catabolite-repression, Lysine, Bacterial population, Replica ploting, Enzymatic capacity, Substrate concentration.

The purpose of the study is to discover the nature of certain metabolic control mechanisms such as induction, repression and catabolite repression in microbial populations. A natural microbial population was selected in a medium containing L-lysine as the sole carbon source and ammonia as the nitrogen source. Experiments were performed at room temperature. Cells were harvested from a batch-operated fermentor containing lysine and were grown through one transfer on lysine, glucose or a mixture of lysine and glucose. By comparing the substrate removal rates and enzymatic capabilities of the cells, it was determined that inducible enzyme systems responsible for lysine degradation were subject to catabolite repression. It was noted that the presence of flucose in the medium decreased the differential rate of activity of the cultures. Results of replica ploting showed that all species in the population were capable of participating in the overall response. Glucose represented the formation of the inducible lysine degrading system and metabolic intermediates also exerted the effect. Glucose had no inhibitory effect upon the activity of preformed enzymes. Preinduction by lysine offered only a small degree of protection against repression, but omission of ammonia-nitrogen from the system did not overcome it. (Shankar-Texas)
W71-01838

PAPER AND ALLIED PRODUCTS (LITERATURE REVIEW),
Tufts Univ., Medford, Mass.
George W. Gove, and I. Gellman.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1138-1160, June 1970. 128 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Pulp and paper industry, Water pollution, Biology, Instrumentation, Reverse osmosis, Water reuse, Sludge, Activated sludge, Lagoons, Trickling filters, Ponds.
Identifiers: *Physical-chemical treatment.

Effects of federal and state legislation pertaining to air and water pollution of pulp and papermaking is discussed. The increasing severity of: black liquor spills, color, foam, training of operating personnel, improving sludge handling, technology, etc. is discussed. Factors affecting the appearance of surface waters including natural phenomena were reviewed. The use of ocean outfalls for disposal of pulp mill wastes were studied to determine the dilution and dispersant characteristics of existing effluents through the use of aerial photogrammetry techniques and flourimetric analysis. Several investigations were made on the biochemical oxygenation characteristics of cellulose fibers, the organisms responsible for the degradation of pulp and paper wastes, and the ecological effects of discharging these wastes to rivers. Several method for monitoring the treated effluent are discussed for a wide variety of parameters. A large number of methods are discussed for pulping liquor disposal and recovery; these include the uses of chemical treatment for recovery, reverse osmosis, by-processing, and a wide variety of physochemical treatment methods. The potential reuse of water from many of the sub-systems within paper mills is appraised. Various mill facilities are described in regard to the secondary treatment processes including activated sludge, oxidation lagoons, aerated stabilization basins, trickling filters, and spray irrigation. (Hancuff-Texas)
W71-01839

REMOVAL OF ORGANIC NITRILES FROM WASTE WATER SYSTEMS,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Philip A. Lutin.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1632-1642, September 1970. 1 fig, 7 tab, 6 ref.

escriptors: *Waste water treatment, *Organic ompounds, *Industrial wastes, Activated sludge, xidation.
entifiers: *Nitriles, *Cyanides, Removals.

xidation of organic nitriles were reflected by ox-gen uptake measured on Warburg constant-olume respirometers. Three activated sludges om different types of aerobic treatment plants in e Nashville, Tennessee area were run with each the nitriles tests. The organic nitriles tested were vided into 3 groups: (1) mononitriles, (2) nitriles and (3) aromatic nitriles. The alkanes and onocarboxylic acids corresponding to the nitriles ith regard to the number of carbon atoms in the olecules were studied to determine the effect of rminal grouping on biological oxidation. At a ncentration of 500 mg/l mononitriles are toxic or ry resistant to biological oxidation at 6 hours and hours. At the same concentration dinitriles are xic or extremely resistant to biological oxidations r detention times up to 72 hours. Aromatic triles showed a toxic effect on all three sludge and rongly resisted biological oxidation. Presence of e cyanide group reduces the susceptibility of a olecule to biological oxidation by activated udge. (Hancuff-Texas)
71-01840

ERFORMANCE OF DEEP TRICKLING FIL-ERS BY FIVE METHODS,
egional Inst. of Tech., Jamshedpur (India).
. Hanumanulu.
ournal Water Pollution Control Federation, Vol 2, No 8, p 1446-1457, August 1970. 2 fig, 5 tab, 7 ref.

escriptors: *Trickling filters, *Waste water treat-ent, *Design, *Performance, Sewage treatment, ilters, Data collection, Efficiencies.
lentifiers: *Formulas, Recirculation.

he applicability of five methods for predicting the erformance of deep trickling filters were studied: elz, National Research Council, Ten States, ckenfelder, and Galler and Gotaas. It was con-luded that Velz law cannot be applied beyond a lter depth of 6 feet or where there is recirculation. he NRC formula underestimates the performance ecause the full effect of the depth of the filter is rought into play by recirculation. Efficiency cal-ulated by the Ten States formula depended only n recirculation and in comparison with Velz and NRC formulas predictes results that are closer to bserved values. The Eckenfelder formula gave the est predicted values in the case of filter with recir-ulation. Efficiencies predicted by the Eckenfelder ormula in the case of a filter without recirculation re far from the actual case. The values predicted y the Galler and Gotaas formula are only slightly etter than those found by the Eckenfelder formula n the case of a filter without recirculation. In the ase of a filter with recirculation, the Galler and Gotaas formula is close to the Eckenfelder formula. f the Galler and Gotaas formula is modified so that he depth term exponent is a linear function of ecirculation volumn it becomes equally applicable o filters with and without recirculation. (Hancuff-Texas)
W71-01841

SEPTIC TANK SYSTEMS,
Brown and Caldwell, San Francisco, Calif.
J. A. Cotteral, Jr., and D. P. Norris.
Journal of the Sanitary Engineering Division, Proceedings American Society of Civil Engineers, Vol 95, No SA1, 715-746, February 1969. 4 fig, 5 tab, 39 ref.

Descriptors: *Design, *Septic tanks, *Sewage disposal, *Maintenance, Design criteria, Design standards, Drainage systems, Performance, Pollution abatement, Sewage treatment, Soil disposal fields, Soil properties, Waste water treatment.
Identifiers: *Drainfields, Capacity, Requirements.

In areas without community sewerage, the installation of individual sewage disposal systems ranges from simple cesspools to complex aerobic treatment units. The most common type of individual sewage disposal system consists of a septic tank and drainfield. The historically high failure rate of septic tank systems has shown them to be unreliable and unpredictable. However, it is possible to design, construct and operate systems in suitable areas for which a high degree of reliability over a reasonable life period can be expected. A minimum septic tank capacity of 1200 gal. should be provided, with an additional 250 gal. per bedroom for homes larger than four bedrooms. Septic tanks should be water tight, constructed of reinforced concrete or precast concrete with reinforced top, and should be 2-compartment tanks of standard proportions as required by the USPHS Manual of Septic Tank Practice. Septic tanks should receive all domestic, laundry, and sanitary wastes, but should exclude roof and area drainage and groundwater. Tanks should have a minimum of 8 in. of cover. Drainfield trenches should be a minimum of 12 in. and a maximum of 18 in. wide and not less than 50 ft nor more than 100 ft. in length. A loading rate of 600 sq. ft. per bedroom is recommended. (Aguirre-Texas)
W71-01842

FOAM SEPARATIONS FOR INDUSTRIAL WASTES: PROCESS SELECTION,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
Robert B. Grieves.
Journal Water Pollution Control Federation, Vol 42, No 8, Part II, p R336-R344. 7 fig, 2 tab, 18 ref.

Descriptors: *Industrial wastes, *Foam separation, *Chromium foam fractionation, Waste water treatment, Air, Aeration, Costs, Design, Chemical precipitation.
Identifiers: *Treatment processes, Flotation, Chemical removal, Clarification.

Foam separations have been shown to be feasible in a number of waste treatment applications. Two parameters, one a concentration ratio and the other a quantity ratio have been indicated to be particularly useful in evaluating the effects on the extent of separation of key independent variables. Frequently the process choice may be left to the design engineer. In this case he should select a process involving the flotation of colloidal or already precipated particles as opposed to the foam fractionation for ion flotation of soluble species. A variety of operational modifications are available. The two state precipitation flotation of Cr (III) hydroxide is a feasible process for the treatment of chronium wastes, with an operating cost of $0.67/lb Cr. An additional choice to be made is that between dissolved air and dispersed air foam separation. For the removal of sediments from natural waters the operating costs are $0.50/1000 gal for dispersed air and $0.60/1000 gal for dissolved air, producing excellent calcification of very turbid waters. (Hancuff-Texas)
W71-01843

ECONOMIC TRANSPORT OF DIGESTED SLUDGE SLURRIES,
Rand Development Corp., Cleveland, Ohio.
Bertram C. Raynes.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1379-1386, July 1970. 2 fig, 2 tab, 31 ref.

Descriptors: *Sludge, *Transportation, *Costs, *Sludge disposal, Design, Pipelines, Land reclamation, Slurries, Waste water treatment.
Identifiers: *Digested sludge.

Pipeline transport of digested sludge to disposal areas located at considerable distance from the generating treatment plant may offer the waste water plant operators substantial economic benefits. The cost savings of transportation of the digested slurry is related to the distance, the quantity, the solids concentration and other variables. The sludge slurries vary in flow behavior as a function of solids concentration. At solids concentrations above 5% they behave as Bingham plastics while below 5% their behavior is Newtonian. Pipelining in the Newtonian region should be the most economical procedure despite the increased volumn of material to be transported. Even where dilution is practiced the quantity of digested sludge available from many waste water treatment plants dictates the use of pipelines perhaps as small as 2 inches in diameter. Another purpose of this investigation is to encourage the use of digested sludge slurries in the reclamation of land areas in need of revegatative assistance and in particular those strip mine areas or similar land areas that constitute water pollution problems in themselves. (Hancuff-Texas)
W71-01844

OPTIMUM WASTE TREATMENT PLANT DESIGN UNDER UNCERTAINTY,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Paul M. Berthouex, and Lawrence B. Polkowski.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1589-1613, September 1970. 9 fig, 8 tab, 32 ref.

Descriptors: *Waste water treatment, *Optimization, *Sewage treatment, *Design, Systems analysis, Costs, Statistics, Constraints, Activated sludge, Computer programs.
Identifiers: Uncertainty, Variants, Algorithms, Sensitivity.

Simple methods for evaluating the different sources of uncertainty that face the design area of waste treatment systems and incorporate waste treatment systems are outlined. The methods incorporated these evaluations into a systems optimization scheme. The design of the individual treatment plant is reviewed. Use of various estimates for the parameters to estimate uncertainty in process performance is discussed. A model of the activated sludge process is developed relating to the performance of primary and final clarifier. Formulas for developing cost data are presented. Penalty costs were used to simplify the calculations and force the optimum design to meet certain constraints. The Hooke-Geeves method is presented and discussed as an easily implimented method. (Hancuff-Texas)
W71-01845

INFLUENCE OF DOMESTIC WASTE WATER PRETREATMENT ON SOIL CLOGGING,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
R. Laak.
Journal Water Pollution Control Federation, Vol 42, No 8, Part I, p 1495-1500, August 1970. 2 fig, 2 tab, 9 ref.

Descriptors: *Sewage treatment, *Soils, *Waste water treatment, Percolation, Biochemical oxygen demand, Effluents, Aerobic treatment, Anaerobic conditions.
Identifiers: *Clogging, Suspended solids, Plugging.

Increase pretreatment of domestic waste water prior to soil application resulted in reducing the clogging rate of the soil surface. A laboratory study with 30 soil columns, 3 different soils and septic tank and extended aeration effluent was carried out. The soils were intermitantly loaded at 80 minute intervals with the effluent up to clogging failure which was reached within 180 days. The service of the soil surfaces was increased when the concentration of total suspended solids, BOD and the hydraulic loading were decreased. Total failure load expressed by the sum of total suspended solids and BOD was directly related to the non-capillary porosity of the soils. (Hancuff-Texas)
W71-01847

TREATMENT OF FRUIT PROCESSING WASTE BY AERATION,
Gray and Osborn, Yakima, Wash.

Larry A. Esvelt, and Hearbert H. Hart.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1305-1326, July 1970. 13 fig, 5 tab, 16 ref. FWQA Grant WPRD 58-01-68.

Descriptors: *Industrial wastes, *Aeration, *Fruit crops, *Activated sludge, Waste water treatment, Biological treatment, Operations, Nutrients, Costs, Tanneries, Efficiency, Lagoon.
Identifiers: *Fruit processing, Growth.

The waste treatment system of a cooperative fruit processing cannery was studied for two operating seasons to determine treatment efficiency and to establish parameters for the treatment of liquid fruit processing wastes by aeration. The cannery processes pears, peaches, apples, and other fruits in a lesser amount. The facilities operate at a flow of 0.5 to 2.5 mgd and up to 25,000 lbs per day of BOD. Activated sludge or contact stabilization treatment of fruit processing waste at low rates will provide greater than 90% removal of organic load and solids from the effluent. Aerated lagoon treatment can provide greater than 80% BOD removal but suspended solids remain in the effluent. Final clarification is successful by low surface loading rates, less than 400 gpd per sq. foot. Nutrient addition is necessary to achieve successful treatment. The cost of the treatment is estimated at $0.41 per pound of BOD removed from aerated lagoons, $0.061 per pound of BOD removed from activated sludge and $0.067 per pound of BOD moved from contact stabilization. Data were collected on biological substrate assimilation, sludge growth, oxygen uptake and sludge settability. Constants were obtained for substrate removals, sludge growth rate, endogenous respiration and oxygen requirements. (Hancuff-Texas)
W71-01848

MEASUREMENT AND SIGNIFICANCE OF ADENOSINE TRIPHOSPHATE IN ACTIVATED SLUDGE,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Ames W. Patterson, Patrick L. Brezonik, and Hugh D. Putnam.
Environmental Science and Technology, Vol 4, No 7, p 569-575, July 1970. 10 fig, 1 tab, 25 ref.

Descriptors: *Activated sludge, *Energy, *Biomass, Sewage treatment, Waste water treatment, Microbiology, Laboratory tests, Metabolism, Productivity.
Identifiers: *Adenosine triphosphate, Organisms, Theory.

A method for adenosine triphosphate (ATP) measurement in activated sludge has been developed from the firefly reaction of luciferin, luciferase, and ATP in which light production is proportional to ATP present. Of several technique variables investigated, temperature of ATP extraction from cells was found to be highly critical; extraction solutions a few degrees below boiling yield much less ATP. The finalized procedure is highly sensitive and reliable; relative standard deviations for activated sludge replicates are commonly less than 2% and recovery of added ATP from activated sludge are relatively constant 100%. ATP levels in activated sludge are relatively constant under endogenous conditions, indicating the potential of ATP as an estimate of viable biomass and respond rapidly to induced changes in metabolic activity. The advantages of an activity parameter over historically used biomass parameters for activated sludge operation control are manifold; ATP assay holds promise as a sensitive tool for future research on sludge activity and process control. (Hancuff-Texas)
W71-01849

GOOD MANAGEMENT INCLUDES EFFECTIVE SAFETY PROGRAMS,
Water Pollution Control Federation, Washington, D.C.
Bob G. Rogers.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1614-1620, September 1970. 1 fig, 2 tab, 2 ref.

Descriptors: *Management, *Safety, *Administration, Cost, Insurance, Operations, Waste water treatment, Sewage treatment, Programs.
Identifiers: Injuries, Records.

Through surveys of waste water collection and treatment systems in the United States the Water Pollution Control Federation has determined that the safety record in the waste water pollution control field is worse than that in any of 41 industries reporting regularly to the National Safety Council. This poor record is costing the field more than $30,000,000 each year in added insurance cost, lost time and reduced productivity. Personnel morale and public image are among other factors sustaining damage but to which no monetary value may be assigned. The Federation has developed safety promotional materials aimed at first convincing management of the need for and value of safety programs and going on to furnish specific aids and training materials for safety. (Hancuff-Texas)
W71-01850

CHARGES FOR TREATING INDUSTRIAL WASTE WATER IN MUNICIPAL PLANTS,
World Health Organization; and John Hopkins Univ., Baltimore, Md. Dept. of Sanitary Engineering.
Yves Maystre, and John C. Geyer.
Journal Water Pollution Control Federation, Vol 42, No 7, p 1277-1291, July 1970. 2 fig, 6 tab, 3 ref.

Descriptors: *Industrial wastes, *Sewage treatment, *Cost, Waste water treatment, Mathematical models, Biochemical oxygen demand, Waste disposal.
Identifiers: *Charges, Suspended solids, Computations, Expenses.

A survey of current practices of charging for discharge of industrial waste into municipal sewers in the U.S.A. revealed that the surcharges may be expressed in a single form that takes into account the biochemical oxygen demand and suspended solids of the waste. A suggested two step procedure may be used to calculate the charges for domestic waste, waste from normal industries and the surcharges for industries with unusually strong wastes. The suggested approach provides for equitable charges which avoiding the expense of individual sampling of all industrial effluents. A set of sample calculations is given for a city treating 10,000 million gallons per year with an average BOD of 368 mg/l and 338 mg/l suspended solids. The total industrial waste water amounts to 3,850 million gallons per year. Four industries have been selected as having very high loads. The individual surcharge factors are calculated and applied to these four industries according to the nature of their flow and strength. (Hancuff-Texas)
W71-01851

INFILTRATION IN SEPARATE SANITARY SEWERS,
Riddle Engineering, Inc., Kansas City, Mo.
W. G. Riddle.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1676-1683, September 1970. 4 fig.

Descriptors: *Infiltration, *Sewers, Costs, Runoff, Maintainance, Repairing, Storm runoff, Construction, Waste Water Treatment.
Identifiers: *Detection methods.

Results of a two year survey in the matter of eliminating infiltration and stormwater in sewage systems in Western Missouri and Eastern Kansas is reported. A questionaire was mailed to approximately 50 pollution abatement facility managers and 49 replied. Location of storm water inlets is made by a comprehensive, economical smoke testing program which allows visual identification of contributing roof leaders, street inlets, broken pipes, ruptured manholes and yard, driveway or area-way drains. Infiltration and its correction is a separate problem. Visual observation is practicable only by television or photography; however, a recent development which is receiving considerable and favorable attention is low pressure air testing. Once the exact or general location and character of infiltration has been determined the effects may be corrected in one of the following ways: (1) excavation and replacement or repair, (2) localized pressure grouting from within, (3) generalized low pressure sealing from within, (4) lining to a reduced diameter, (5) pressure grouting from without. Cost for the various methods are presented. The supplier of sealing chemical claims sealing efficiencies range from 70 to 95%. Costs of treating and 8 inch sewer ranged from 80 cents to a $1.00 a foot plus the cost of chemical. It is concluded that there is no satisfactory repair or maintainance substitute for high quality initial construction. (Hancuff-Texas)
W71-01852

FEASIBILITY OF A SPORT FISHERY IN TERTIARY TREATED WASTE WATER,
Arizona Cooperative Fishery Unit, Tucson.
Robert J. Hallock, and Charles D. Ziegell.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1656-1665, September 1970. 3 fig, 4 tab, 20 ref.

Descriptors: *Tertiary treatment, *Fisheries, *Waste water treatment, *Feasibility studies, Fish farming, Filtration, Fish, Biomass, Food chains, Photosynthesis, Phosphours, Trout, Catfishes.

Specific objectives of this study were to determine a suitable fish species, their survival, growth and yield in tertiary treated waste waters and to evaluate food chain relationships. Physical and chemical parameters such as temperature, DO, pH, and orthophosphate were also considered. The tertiary treatment consisted of spreading activated sludge effluent over sand and gravel filters. Horizontal filtration distances varied from 50 to 100 feet while vertical filtration distances varied from 3 to 20 feet. Fish tested were channel catfish, rainbow trout, and Malacca tilapia hybrids. The final fish survival percentages differ greatly from pond to pond. In two of the three initial channel catfish experiments and in all the tilapia experiments survival exceeded 70%. Survival did not exceed 1% in any of 5 trout experiments. An important cause of death was the low oxygen concentration and high ammonia concentrations. Oxygen was measured as low as 2.7 mg/l and ammonia was as high as 11 mg/l. The large variation in oxygen concentrations seems to be a result of respiration by dense phytoplankton blooms which were stimulated by high inflow orthophosphate concentrations, 14 mg/l. The highest combined yield of locally acceptably channel catfish and talipia from one pond was 697 lbs per acre, yield much greater than that from natural waters. Chironimus larva, the predominant food organism, comprised 90% of the estimated annual benthos production of 12,680 lbs. per year per acre. (Hancuff-Texas)
W71-01853

A NEW APPROACH TO CONTROLING BIOLOGICAL PROCESSES,
Southwest Research Inst., San Antonio, Tex.
Leland L. Hiser.
Environmental Science and Technology, Vol 4, No 8, p 648-651, August 1970. 3 fig, 1 tab, 4 ref.

Descriptors: *Biological treatment, *Control, *Carbon, Waste water treatment, Sewage treatment, Biochemical oxygen demand, Energy.
Identifiers: Total oxygen demand, Volatile solids.

Some criticism is given of the current use of the BOD test as a control paramente for waste water treatment systems. It is felt that separate parameters to describe 3 distinct variables--food, energy, and culture--would lead to a simpler and more

idely understood concept of the biological ystem. Since carbon is a basic food supply of living natter, it is logical that it should be a primary arameter for describing both of the food supply nd the culture content from microbiological ystems. A simplified carbon nomenclature is used o describe the many forms in which carbon can be resent. In the liquid phase it includes dissolved or-anic carbon and dissolved inorganic carbon; the olid phase includes suspended organic carbon and uspended inorganic carbon, the gas phase includes as organic carbon and gas inorganic carbon. It is uggested that the energy requirement can be etermined as the total change in oxygen demand f the system coincident with the conversion of car-on. It is stated that this approach will assistin the reakdown of biological treatment process into a eries of describable unit operations which are menable to material balances and more precise escriptions of unit rate. Two advantages of this ype of analysis are: (1) analytical time is reduced rom days to minutes and (2) it is possible to make oth materials and energy balances. (Hancuff-Tex-s)
V71-01854

KINETICS OF THE MICROBIAL DECOMPOSI-TION OF THE HERBICIDES IPC AND CIPC,
Oregon State Univ., Corvallis. Dept. of Agricul-ural Chemistry.
Paul G. Moe.
Environmental Science and Technology, Vol 4, No , p 429-431, May 1970. 3 tab, 6 ref.

Descriptors: *Degradation (Decomposition), *Kinetics, *Herbicides, Microorganisms, Bacteria, Growth rated, Energy, Hydroloysis, Organic com-pounds, Soils, Waste water treatment.
Identifiers: Reactions.

ncubation instruments using IPC and CIPC as pri-nary carbon sources for the growth of Pseu-lomonas striata were conducted at 20 and 30C. Reaction rate constants for the initial hydrolysis reactions were calculated from an equation based n both the herbicide concentration and the bac-erial mass present in the system. The IPC concen-rations were 50, 100 and 200 ppm and because of he water solubility of CIPC concentrations of 25, 50 and 100 ppm were employed. Good bacterial growth was obtained in all the inoculated flasks. Lag periods varied considerably with initial herbi-cide concentration particularly with IPC, but averaged about 40 hours for IPC and about 130 hours with CIPC. The length of the logarithmic growth phase generally increased with the initial herbicide concentration ranging from 16 to 40 hours. The ratio of bacterial mass formed for the unit of herbicide decomposed, essentially a mea-surement of metabolic efficiency, varied from 6.8 to 9.2% with IPC and from 3.0 to 5.0% with CIPC. Activation energy required for the hydrolysis of IPC was about 4 K cal/mole whereas for the hydrol-ysis of CIPC it was 2 K cal/mole. (Hancuff-Texas)
W71-01855

DIGESTION FUNDAMENTALS APPLIED TO DIGESTER RECOVERY--TWO CASE STUDIES,
Iowa Univ., Iowa City. Dept. of Civil Engineering.
Richard Dague, Robert L. Hopkins, and Robert W. Tonn.
Journal Water Pollution Control Federation, Vol 42, No 9, p 1666-1675, September 1970. 2 fig, 2 tab, 16 ref.

Descriptors: *Control, *Digestion, *Anaerobic digestion, Hydrogen ion concentration, Alkalinity, Ammonia, Industrial wastes, Waste water treat-ment, Methane.
Identifiers: *Case studies, *Upset recovery, Volatile acids, Gas production.

The anaerobic digestion systems of concern are located at Clinton and Keokuk, Iowa. Both systems received significant solids from grain and processing industries. Initial conditions at Clinton were pH 5.5 to 6.0, volatile acids 4000 to 5000 mg/l, alkalinity 2000 mg/l, gas production 0. At Keokuk initial conditions were pH 6.0 to 6.3, volatile acids, 8000 mg/l, alkalinity 3,000 mg/l, gas production 0. Alkali was added to raise the pH to about 6.8. The recovery at Clinton showed significant gains only when the pH was greater than 6.5. Part way through the recovery period at Keokuk the addition of lime was halted in favor of aqueous ammonia. The use of ammonia to neutralize 10,000 mg/l of volatile acids resulted in ammonia toxicity and cessation of gas production. At this time the concentration of ammonia in the system was 2,500 mg/l as NH3. There is no apparent relationship between the concentration of volatile acids in the digester and the ranges of gas production. A definite relationship between pH and the rate of gas production is apparent; the minimum pH indicated is 6.5. (Hancuff-Texas)
W71-01856

PETROLEUM PROCESSING WASTES (LITERATURE REVIEW),
Maine Univ., Orono.
Millard W. Hall.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1205-1211, June 1970. 31 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Oil costs, Design, Waste disposal, Biological treatment.
Identifiers: *Petroleum wastes, Refineries.

Recent literature in the petroleum processing wastes area is summarized. A large scale joint industry waste disposal facility on the Houston ship channel is discussed. The ten thousand ton per month capacity facility will handle liquid solids and semi-solid wastes. In-plant measures of reducing the waste water discharge problems in the petroleum refining industry is presented and a variety of examples given. A system for the thermal decomposition of fluidized industrial wastes was developed. It operates at approximately 2,000F and destroys most types of liquid and semi-liquid wastes, virtually elimating both water and air pollution. Several methods of treating oils are discussed and include sedimentation, biological processes, and sand filtration. The development of waste water management programs is described and an example is sited in which the effluent stream from a treatment facility is utilized in ponds which have developed into a bird sanctuary and apparently become an asset to the community. Some data is presented for the biological treatment of combined petrochemical and municipal waste water. An environmental management program undertaken in the planning and development of a major new petrochemical facility is presented. Water conservation waste treatment methods are discussed for a 125,000 bbl per day refinery. Deep-well disposal techniques for the disposal of both liquid and liquid solids wastes streams are presented. Several sources concerned with the biologic oxidation of petroleum wastes are summarized. (Hancuff-Texas)
W71-01857

DEVELOPMENT OF A FLUIDIZED-BED TECHNIQUE FOR THE REGENERATION OF POWDERED ACTIVATED CARBON,
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
A. K. Reed, T. L. Tewksbury, and G. R. Smithson, Jr.
Environmental Science and Technology, Vol 4, No 5, p 432-437, May 1970. 4 fig, 5 tab.

Descriptors: *Activated carbon, Adsorption, *Sewage treatment, Waste water treatment, Tertiary, Treatment efficiency, Performance.
Identifiers: *Fluidized-bed, *Regeneration, Variables, Losses, Pulsing.

The study on the regeneration of spent powdered carbon was directed toward the development of a fluidized-bed regeneration technique. Two fluidized-bed systems were considered during the course of the investigation. A system in which the dried spent carbon was regenerated during its passes through a fluidized-bed of an inert material; and a pulsating fluidized bed system in which the finely divided regenerated carbon served as the bed material. A major portion of the experimental study made upon the fluidized inert bed system consisted of an evaluation of the fluidized technique. The major variables examined and ranges studied during the program were as follows: temperature - 500 to 1500F, composition of the fluidizing gas-selected mixtures of nitrogen, oxygen, carbon dioxide and water, bed weight - 0 to 6,720 grams, bed depth - 0 to 11.5 inches, moisture content of feed- 0.5 to 50% water. Data obtained during these experiments are tabulated and compared. In the study of the pulsed fluidized-bed system the pulsations were obtained by simply interrupting the flow of fluidizing gas with frequencies on the order of 400 to 500 pulses per minute. With the fluidized inert bed system regenerated carbon products were obtained which has absorptive capacities of 100% when compared with virgin activated carbon. The weight recoveries were as high as 88%. Similar regeneration also was obtained with the pulse fluidized-bed system. (Hancuff-Texas)
W71-01858

A MASTER PLAN REPORT FOR THE ATLANTIC COUNTY NEW JERSEY PLANNING BOARD, WATER AND SEWER STUDIES.
Atlantic County Planning Board, Atlantic City, N.J.

Available from NTIS as PB-189 718, $3.00 in paper copy, $0.95 in microfiche. Atlantic County Planning Board, October 1969. 60 p folder, 13 tab. HUD Project N.J.-99.
Identifiers: *Urban planning, *New Jersey, *Water supplies, Urban planning, *Sewage, Sanitary engineering, Water pollution, Fire safety, Water resources, Surface waters, Waste water treatment, *Atlantic County (New Jersey), *Area planning and development.

Existing sewerage and water facilities are dealt with and some proposals are made for a future County-wide sewer system. Planning for future water supply is discussed along with the nature and types of pollution and the types of surface water according to the uses for which it is suited. Existing sewerage facilities are indicated in the three regions into which the County is divided. Three alternative comprehensive County sewerage plans are outlined. Existing water supply and fire protection in Atlantic County is described along with planning for future water supply. Four large maps are included showing: surface water quality, existing waste water treatment facilities alternative sewerage facility plans, and existing water supply facilities.
W71-01875

METABOLIC STORAGE OF PHOSPHORUS IN THE ACTIVATED SLUDGE FLOC,
Marquette Univ., Milwaukee, Wisc. Dept. of Civil Engineering.
S. K. Malhotra.
Available from NTIS as PB-195 980, $3.00 in paper copy, $0.95 in microfiche. Wisconsin Univ. Water Resources, Technical Completion Report, July 1970. 80 p, 8 fig, 72 ref. OWRR Project A-015-WIS (1).

Descriptors: *Phosphorus, *Activated sludge, *Calcium, *Iron, *Waste water treatment, Sewage treatment, Flocculation.
Identifiers: *Cations, *Synthetic feed, *Secondary waste treatment, Mixed liquor.

Two laboratory batch aeration units were operated under similar conditions using synthetic feed with and without phosphates. With synthetic feed, the normal activated sludge flocs after being washed off of their cations exhibited a phosphorus storage between 2.5% and 2.9% based on the mixed liquor

volatile suspended solids (MLVSS). The storage of phosphorus was found to be independent of MLSS and organic load levels. The phosphorus starved activated sludge flocs also exhibited identical phosphorus storages. This agrees with the findings of Menar and Jankins (1968) that the biologically incorporated phosphorus in the activated sludge floc varies between 2% and 3% based on the volatile mass of activated sludge. After test runs exhibited practically the same percent phorphorus in the volatile mass, the units were subdivided and fed with the same standard synthetic feed except that different amounts of cations (Ca.... and Fe.....) were added to it to obtain the increase in the percent phosphorus in the cell mass due to the cations in the feed. The percent phosphorus incorporated in the volatile mass was increased from an average of 2.89% to 3.44% with 40 mg/l of Ca.... and from 2.89% to 4.27% with 120 mg/l of Ca.... in the feed. The corresponsing calcium content of the sludge was 3.1% and 5.1% on the volatile mass basis. Similarly 15 mg/l and 30 mg/l of Fe..... in the feed enhanced the percent phosphorus in the volatile mass. (Malhotra-Wisconsin)
W71-01896

WATER QUALITY CONTROL WITH SYNTHETIC POLYMERIC FLOCCULANTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
J. K. Dixon.
Available from NTIS as PB-195 983, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, November 1970. 4 p. OWRR Project A-016-CONN (1).

Descriptors: *Flocculation, Filtration, Electrophoresis, Settling, *Algae, *Silica, *Bacteria, Water pollution control, Waste water treatment.
Identifiers: Polyacrylamide, Polyethylenimine.

Studies have been made of the flocculation of silice, algae and bacteria by means of low concentrations of synthetic polymers. The effects of polymer molecular weight and structure have been emphasized, using the silica, and pure cultures of green algae and E. coli under a variety of conditions of pH and colloid concentration. Filtration rate, light transmission and electrophoretic mobility have been employed to measure degree of flocculation. Non-ionic and anionic polymers did not produce flocculation, but cationic polyethyleneimines were effective at concentrations of 0.1 to 100 ppm, the optimum being dependent on pH, colloid concentration and polymer molecular weights above about 2000. Algae required some 30 to 500 times higher solution concentration of polymer than did the bacteria and silica, respectively. Two types of polyethyleneimine polymer tagged with radioactive C14 were prepared which flocculated the three kinds of colloids in the same way as untagged polymers. In the region where flocculation was optimum the concentrations of polymer adsorbed on the colloid surfaces stood in roughly the ratio1:10:200 for silica, E. coli and algae, respectively. Poor flocculation efficiency was not to be associated with low adsorption, but to specific polymer-surface interactions which reduced the efficiency of the adsorbed polymer. The results have been shown to conform with current theories of flocculation of other colloids. They should assist in attaining better water quality control by the use of the synthetic polymers in numerous practical operations. (Dixon-Conn)
W71-01899

FLOCCULATION OF COLLOIDS WITH POLYELECTROLYTES IN AQUEOUS SALT SOLUTIONS,
Rhode Island Univ. Kingston. Dept. of Civil Engineering.
Donald L. Sussman.
Available from NTIS as PB-195 977, $3.00 in paper copy, $0.95 in microfiche. Technical Completion Report, Rhode Island Water Resources Center, October 1970. 14 p. OWRR Project A-024-RI (1).

Descriptors: *Flocculation, Coagulation, *Polyelectrolytes, *Colloids, *Corn starch, *Tannic acid, *Calcium ion, Waste water treatment.
Identifiers: Sodium polystyrene sulfonate, *Chloride, *Refiltration rate, *Turbidity, *Flocs.

The purpose of this research was to observe the behavior of organic colloids in the presence of polymeric flocculants and the ionic salts NaCl, NaClO4)2. The study was defined in terms of the flocculation kinetics and the absolute turbidity. In the flocculations of corn starch, and tannic acid the presence of the calcium ion greatly accelerated the rate of flocculation, and chloride ion had a slight desruptive effect on floc formation. The flocculation studies were confirmed by refiltration rate experiments where the floc sizes were determined. The flocs with calcium ion were the largest and those with chloride the smallest. (Sussman-Rhode Island)
W71-01901

ACTIVATED CARBON RECLAIMS WATER FOR CARPET MILL,
Stephen-Leedon Carpet Co.
William H. Phipps.
Water and Wastes Engineering/Industrial, Vol 7, No 5, p C22-C23, May 1970. 2 fig.

Descriptors: *Activated carbon, *Reuse, *Waste water treatment, Color, Chemicals, Organic matter, Dewatering, Water temperature, Adsorption, *Pennsylvania.
Identifiers: *Carpet mill waste water, Dyes.

To meet pollution control laws, the Hollytex Carpet Mills installed waste water reclamation system in a new plant. The waste water from the dyeing, rinsing, vacuum dewatering process contains lint, dyes, chemicals, organic matter, color, and turbidity. At production capacity, 500,000 gpd is discharged. The reclamation system has an adsorber containing 50,000 lbs. of Filtrasorb (a Calgon Corp. product) granular activated carbon, to achieve 80% recovery of waste water. The activated carbon is a high density, high porosity carbon. Pole structure is carefully controlled to provide effective adsorption of both high and low molecular weight organic impurities. Mesh is 12 x 40 U.S. Std. Prior to the adsorption unit, the waste water passes through two stainless steel lint removal conveyors. The carbon is contained in a plastic-lined, mild steel adsorber, 27 x 9 ft, 9 in. in diameter. The waste water flows upward through the moving bed adsorber. Spent carbon is conveyed in a water slurry to a holding tank from where it is educted to a combination dewatering furnace feed screw. Carbon is reactivated in a multiple-hearth, gas-fired furnace equipped with a wet scrubber for removal of particulates from exhaust gases. Reactivated carbon is discharged from the furnace to a quench tank and then to a pressure vessel from where it is hydraulically transported to a feed tank atop the adsorber. Losses are expected to be about 5%. Purified water flows to a cooling tower where it is cooled to 90LF. from an incoming temperature of 180LF. (Selby-Texas)
W71-01966

THERMOPHILIC ACTIVATED SLUDGE PROCESS,
Mississippi State Univ., State College.
Adnan Shindala, and James E. Parker.
Water and Wastes Engineering, Vol 7, No 3, p 47-49, March 1970. 2 tab, 3 fig, 8 ref.

Descriptors: *Activated sludge, *Thermophilic bacteria, Biochemical oxygen demand, Organic loading, Waste water treatment, Sewage treatment.
Identifiers: *Raw sewage, Solids return.

The ability of thermophilic aerobic microorganisms to provide adequate treatment of a waste by activated sludge process under varying organic loading conditions is discussed. Laboratory data show that at 55 degrees C, with no solids return, the overall BOD reduction was 94% under varying organic loading conditions. Decreasing the detention time has no apparent effect on the BOD reduction efficiency. With a return solids ratio of 1:1, the average BOD reduction efficiency was 85%. A variation of mixed liquor suspended solids concentration from 200 to 650 mg/L had no apparent effect on the removal efficiency. (Selby-Texas)
W71-01967

COLDWATER CREEK WASTE WATER TREATMENT PLANT,
Joseph W. Larson.
Water and Wastes Engineering, Vol 7, No 4, p 44-48, April 1970. 3 tab, 3 fig.

Descriptors: *Waste water treatment, *Treatment facilities, Design, Sewage treatment, Missouri, Activated sludge.
Identifiers: *St. Louis (Mo).

Because of the rapid growth of the Metropolitan St. Louis area and because the Coldwater Creek is substantially dry, the area adjacent to the Coldwater Creek waste water treatment plant and downstream requires the discharge of a high quality effluent. For these reasons, the plant is of the activated sludge-type that provides for the chlorination of the plant effluent and, if necessary, for odor control, the plant influent and digester supernatant as well. Treatment consists of grit removal followed by comminution, primary settling, aeration, final settling, and chlorination before the effluent is discharged into Coldwater Creek. Primary and waste-activated sludge, sometimes thickened, is pumped into digesters. The digested sludge is disposed of in open sludge storage basins. When necessary, digester supernatant can be returned to the raw sewage flow or to the aeration basins in order to increase the solids loading. In addition to the pump and blower building, major structures include the grit basins and comminutors, primary settling tanks, aeration tanks and control building, final clarifiers, sludge thickener, digesters, chlorination facilities, and shope and garage areas. The 40-acre treatment plant complex is situated on a 78-acre tract north of Coldwater Creek and 11 miles north of the center of St. Louis. (Selby-Texas)
W71-01968

SINGLE-STAGE LIME CLARIFICATION OF SECONDARY EFFLUENT,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
E. L. Berg, C. A. Brunner, and R. T. Williams.
Water and Wastes Engineering, Vol 7, No 3, p 42-46. 7 fig, 1 tab, 6 ref.

Descriptors: *Effluents, *Filters, Turbidity, Lime, Water reuse, Reclaimed water, Waste water treatment, Tertiary treatment.
Identifiers: *Clarification, Anthracite filter, Sand filter, Characteristics.

This study was undertaken to produce suitable clarified water from secondary effluent for an advanced waste treatment system which includes granular activated carbon treatment and electrodialysis. The clarifier was operated at various pH values to ascertain also the effects upon those constituents normally present in secondary effluent. Results showed that a lime clarification system can be effective and economical tool for the clarification of relatively hard waste water. Water of high clarity, however, is obtainable only during optimal operation of the biological oxidation process. The system also removed large amounts of phosphate, a major nutrient that supports algae life. The economics of the system are comparable with other forms of clarification. (Selby-Texas)
W71-01969

ADVANCED WASTE TREATMENT IN NASSAU COUNTY, NEW YORK, WATER PROVIDED FOR INJECTION INTO GROUNDWATER AQUIFERS,
Burns and Roe, Inc., Oradell, N.J.
John L. Rose.

Water and Waste Engineering, Vol 7, No 2, p 38-39, February 1970. 2 fig, 3 tab.

Descriptors: *Waste water treatment, *Tertiary treatment, *Water reuse, Aquifers, Activated sludge, Coagulants, Injection wells, Observation wells, Costs, New York.
Identifiers: *New York, *Hydraulic barrier, Backwash, Nassau County (N.Y.).

To meet a threat of salt water intruding into its aquifers, Nassau County, New York, considered a proposal which would allow an increase of the permissible withdrawals, to create a hydraulic barrier in the aquifer, which would prevent both the natural outflow, now lost to the sea, and the intrusion of salt water. The barrier would be formed by injecting treated waste water through a series of recharge wells. For evaluation purposes, a 400 gpm demonstration plant was constructed. The plant provides tertiary treatment for the effluent of the conventional activated sludge plant. The product water is pumped about one-half mile to a test injection site. The tertiary treatment plant is a conventional water treatment plant modified to utilize secondary effluent as a water source. Effluent is pumped into a clarifier to which alum and coagulant aids are added. The supernatant flows by gravity to two mixed media filters operated in parallel. Final backwash is semi-automatic and includes air scour, surface wash, and high-and low-rate backwashing. Filter effluent is pumped through four granular activated carbon adsorbers. The renovated water is disinfected with chlorine before being pumped to the injection site. The injection facilities consist of a storage tank, a degasifier for removal of dissolved gases, injection and redevelopment pumps, an injection well, and 12 observation wells. The injection well is 36 inches in diameter by 500 feet deep and contains an observation well and geophysical probes. Costs are tabulated. Operation of the tertiary treatment plant and injection system since January 1968, confirms the concept of recharging waste waters into the aquifer. The well has been redeveloped after each series of injection tests with negligible loss of capacity. The treatment plant has consistently produced water meeting the injection quality criteria. (Selby-Texas)
W71-01970

DEEP-BED FILTER SYSTEM FOR MILL SCALE REMOVAL,
Dravo Corp., Pittsburgh, Pa. Dept. of Water and Waste Treatment.
Donald F. Heaney.
Water and Wastes Engineering/Industrial, Vol 7, No 3, p B6-B7, March 1970. 3 fig, 1 tab.

Descriptors: *Filtration, *Industrial wastes, Scaling scour, Lake Michigan, Coagulation, Waste water treatment.
Identifiers: *Deep-bed filters, Backwashing.

The Youngstown Sheet and Tube Company added a new 84-inch hot strip mill to its Indiana harbor works in the hope of minimizing the discharge of mill scale and other pollutants into Lake Michigan. The 60,000 gpm treatment facility has 42 deep-bed filters providing 8,900 sq. ft. of filter area. Backwash air is used at a rate of 2,600 cfm when washing two filter tanks. Valves controlling backwash water flow are operated from their own instrument air system. One section of 7 dual filters is backwashed on each shift, with each dual unit requiring 30 minutes for complete washing. The pressure build-up varies between 15 and 25 feet water gauge. If the pressure build-up exceeds a preset figure of approximately 30 feet water gauge, the filters go automatically into backwash in turn. This continues until all filter units have been cleaned. The backwash water is returned to the influent end of the scale pits. Operating experience has proved that addition of a coagulating polymer is not always necessary. The scouring air required in backwash is distributed by a lateral pipe system and is controlled by the 'M' block units. Individual domes in the blocks ensure uniform distribution through the sand during backwash. Backwash water is taken from the filtrate header. The filtrate is emptied into the lake through a continuous monitoring system. Not only did the deep-bed filter system offer substantial savings in space and economics of operation, but results for 18 months of operation have been highly satisfactory. The water coming from the two-scale basins averages 20 to 70 mg/L oil and 70 to 110 mg/L solids. The effluent from the filter averages 3 to 5 mg/L oil and 3 to 5 mg/L solids-about equivalent to the quality of the water taken from the lake. (Selby-Texas)
W71-01971

A TREATMENT PROCESS FOR STRONG CANNERY WASTES,
Oklahoma Univ., Norman. Coll. of Engineering.
George W. Reid, and Leale Streebin.
Water and Wastes Engineering/Industrial Vol 7, No 3, p B1-B5, March 1970. 5 fig, 4 tab, 8 ref.

Descriptors: *Canneries, *Industrial wastes, Design, Treatment facilities, Biological oxygen demand, Waste water treatment.
Identifiers: *Potato wastes.

A small community sewage treatment plant could not accept the high-volume, strong organic wastes of a cannery. After a study was completed, it was recommended that the combined raw waste stream be separated from the municipal waste and routed through a separate treatment system. This system will consist of screens to remove large pieces of waste product, which will be trucked to an existing landfill. The screened waste will flow first to a high-rate minimal-solids aeration basin, designed to remove 50% of the soluble BOD, and then to two low-rate, extended aeration basins for polishing, followed by final clarification. Nutrients will be fed prior to the minimal solids unit to balance the waste for optimal organic removals. Sludge return to the front of all aeration tanks will be provided to maintain a recirculation ratio of approximately 1 to 1. (Selby-Texas)
W71-01972

TREATMENT PLANT DESIGNED FOR FROZEN MEAT WASTES,
Bissell, Merrill and Associates, Williamsville, N.Y.
William H. Merrill, Jr.
Water and Wastes Engineering Vol 7, No 5, p C5, May 1970. 1 fig.

Descriptors: *Design, *Industrial wastes, Lake Erie, Biochemical oxygen demand, Waste water treatment, Aerobic conditions, Aerobic treatment, Flocculation, New York.
Identifiers: *Food processing wastes, Packaging plants, Buffalo (New York).

A packaged frozen meat products plant was established outside Buffalo, New York, where there were no sewers and none planned. Design flows of the plant were 100,000 gpd. In setting up a waste water treatment facility, data from another plant was considered. The pH intensity level of the wastes indicated a biological treatment would be favorable and a nutrionally balanced system would result. However, the high ether solubel content would seriously affect a biological system by imparing the oxygen transfer efficiency of applied air. Therefore a system for removing the ether solubles would have to precede the biological system. This would also affect some BOD removal. Initial treatment of the waters is in an air flotation cell, where grease and fats along with most of the suspended solids are removed. After completion of the flotation process and before entering the aeration unit, the subnatant is mixed with the domestic waste from the inplant population. The combined waste entering the aeration tank is aerated and detained for about 24 hours. During this time, air is continuously mixed with the waste water by means of a surface aerator. From the aeration tank the water is clarified for 4.5 hours. Water leaving the clarifier is chlorinated and discharged through a measurement flume into Lake Erie. The lengthy outfall line acts as a chlorine contact tank. The overall BOD removal efficiency averages 85 to 90% at present and is expected to increase as the plant's experience grows. (Selby-Texas)
W71-01973

PLANNING OF MUNICIPAL WASTE WATER RENOVATION PROJECTS,
Bechtel Corp., San Francisco, Calif. Scientific Development Dept.
J. W. Porter.
Journal of the American Water Works Association, Vol 62, p 543-548, September 1970. 2 tab, 3 fig, 6 ref.

Descriptors: *Waste water treatment, *Municipal water, Planning, Attitudes, Economics, Water reuse, Reclaimed water.
Identifiers: *Public acceptance, Waste water renovation.

The planning of municipal waste water renovation projects will be increasingly important in the water resources field. This is primarily true because of the benefits of water supply and pollution control of such projects. In order to systematically develop such projects it will be necessary to consider economic, technical, institutional, and public acceptance aspects. The basic economic considerations revolve around water pollution control/water supply functions of a water renovation facility, and these same functions in separate, more 'conventional' facilities. The technical considerations are, to a large extent, a function of the planned use of the product water and has aspects of process selection and water quality criteria, reliability, public health considerations, and pilot/demonstration work. A basic operational change occurs when the 'renovation/reuse' concept is substituted for the 'treatment/discharge' concept. The public acceptance of renovated waste water must be carefully considered; and suggested guidelines in planning for public acceptance are: (1) sampling of attitudes, (2) informing local press and civic organizations, (3) keeping public health agencies fully informed, (4) potential users such as industry should be brought into planning early, and (5) water conservation, pollution control and possible economic benefits should be stressed in public announcements. The relative importance of all these aspects of planning for waste water renovation projects will depend on such items as the type of water use envisioned, the project location and the entities involved. (Selby-Texas)
W71-01974

A STUDY OF MEAT PACKING AND RENDERING WASTES,
Wayne State Univ., Detroit, Mich.
Henry A. Dirasian.
Water and Wastes Engineering/Industrial Vol 7, No 5, p C16-C20. 2 fig, 2 tab, 2 ref.

Descriptors: *Industrial wastes, *Sewage treatment, Sewage disposal, Waste water treatment, Michigan.
Identifiers: *Food processing, Wastes, Grease removal, Detroit (Michigan).

A meat packing and rendering firm was informed by the City of Detroit that its effluent did not fall within the city sewer use ordinance as it related to grease content. A study was made to suggest needed action to reduce the amount of grease entering the sewer. The first part of the study indicated the substantial amount of pretreatment of waste water was required if the regulations were to be met. A second step of the study was the construction of a laboratory scale pressure flotation unit. The unit consists of a pressurized chamber in which either plain water of plant effluent is put under pressure and released to the flotation column in which the waste is held. The results of the limited study showed that: pressure flotation, assisted by an acceptable flotation aid (alum in this case), would remove the greater portion of the grease produced in a meat packing and rendering plant; in this study a recirculation ratio of 4 to 1 was maintained and a flotation period of 20 minutes was standard-this 20

minute retention period is somewhat less than the 30 to 60 minute usually provided and will allow the laboratory studies to be extrapolated to a field unit; and the required alum concentration varies lineraly with the amount of SS in the influent in the ranges explored in this study. (Selby-Texas)
W71-01975

NOVEL BIOLOGICAL TREATMENT PROCESS UTILIZED UNIQUE REDWOOD MEDIA,
Cornell, Howland, Hayes and Merryfield, Corvallis, Oreg.
Frank D. Schaunberg, and Sidney Lasswell.
Water and Wastes Engineering Vol 7, No 8, p 34-37, August 1970. 3 fig, 1 tab.

Descriptors: *Activated sludge, *Biological treatment, *Trickling filters, Slime, Void ratio, Biological oxygen demand, Waste water treatment, Oregon.
Identifiers: *Redwood, Support media.

A pilot plant investigation was undertaken during 1969 to evaluate the potential of redwood slats as a biological support media. The process, called Activated Biofilter, is a novel biological treatment designed to combine the desirable features of the fundamental trickling filter and activated sludge processes by circulating a mixed liquor of secondary sludge and filter underflow through a redwood slat biological support media. This lightweight media (10.3 lb/cu ft.) is relatively inexpensive, and appears very durable. The rough-sawn texture of redwood slats facilitates the retention of biological slime. Redwood media has about double the void percentage and void space to surface area ratio found for a comparable volume of 4 inch diameter rock media. The specific surface of redwood media (14 sq ft/cu ft) is slightly greater than that of 4 in. rock. The investigation took place at the Corvallis, Oregon, municipal sewage treatment plant. Findings of the study concluded that the Activated Biofilter process can be expected to produce a high-quality effluent in terms of BOD at loadings of up to 200 lb. BOD per day per 1000 cu ft and with MLSS of 3000 to 6000 mg/L. Shock organic loads and wastes containing significant quantities of carbohydrates can apparently be treated by the ABF process without a severe reduction in treatment efficiency. The activated biofilter system appears to combine the most desired characteristics of the trickling filter and activated sludge processes. Future studies will help determine optimum conditions of media depth, underflow recycle ratio and hydraulic application rates. (Selby-Texas)
W71-01976

CANNING (LITERATURE REVIEW),
G. A. Richter, and M. R. Soderquist.
Journal Water Pollution Control Federation, Vol 42, No 6, p 1165-1171, June 1970. 41 ref.

Descriptors: *Canneries, *Aerobic treatment, *Anaerobic digestion, *Industrial waste, *Waste water treatment, *Organic waste, Activated sludge, Trickling filters, Irrigation systems, Neutralization, Adsorption, Industrial wastes.
Identifiers: *Canning waste treatment, Screening, Food processing.

Both activated sludge process and anaerobic digestion using an anaerobic filter were discussed. Mechanical potato peelers, protein recovery and a dry caustic peeling process are also described. Detailed characteristics of citrus waste and descriptions of various treatment methods and their application to citrus waste water treatment were the subject of several reports. Other reports discussed the results of spray irrigation of food processing waste on fields of fruits and vegetables. The process is suitable for irrigation of crops despite the fact that wastes from fruit and vegetable processing plants are quite variable in chemical composition, depending on the type of crop being processed. Research project results of air flotation, vibratory screening trickling filtration, neutralization, activated carbon adsorption, aerated lagoons, activated sludge systems and high-rate plastic media trickling filters employing forced aeration were reported for treatment of various canning waste. A discussion of several waste disposal systems was presented and several reports gave cost efficiency relationships for (a) land area requirements, (b) capital cost, and (c) operating and maintainance cost for several alternative unit processed for canning-waste treatment. (Waid-Texas)
W71-01977

LIBERTY, S.C. TEXTILE FINISHING WASTE,
South Carolina Pollution Control Authority, Columbia.
G. A. Rhame.
Water and Wastes Engineering/Industrial Vol 7, No 5, p C6, May 1970. 3 tab.

Descriptors: *Aeration, *Design, Textiles, Lagoons, BOD, Sludge disposal.
Identifiers: *Textile wastes, South Carolina.

The ability of extended aeration systems to handle alkali textile wastes has been demonstrated successfully in Liberty, S.C. Biological utilization of the starches and other carbohydrates in cotton finishing mill wastes produces ample carbon dioxide to neutralize the alkali to a satisfactory degree. The flow pattern of the extended aeration system is straight through with a sludge recirculation at 250 gpm. No sludge disposal equipment is necessary because suspended solids are low and can be handled by tank truck. Waste volume has averaged 0.5 mgd, of which 30,000 gpd is sanitary waste. BOD removal is very high. No odors have been observed from nearby houses or the small receiving creek. There has been no need to waste sludge. Sludge settling rate is high. Performance of this plant illustrates the excellent results obtainable when the designer is generous with applied housepower. It is expected that effluent BOD will remain less than 20 mg/l at the design load of 1.0 mgd. Aeration parameters, equipment inventory, and analytical data are tabulated. (Selby-Texas)
W71-01978

WASTE WATER RECLAMATION AND REUSE,
Envirotech Corp., Palo Alto, Calif.
F. P. Sebastian.
Water and Wastes Engineering Vol 7, No 7, p 46-47, July 1970. 1 fig, 1 tab, 12 ref.

Descriptors: *Waste water treatment, *Reuse, *Tertiary treatment, California, Costs.
Identifiers: *Public acceptance.

In March 1968 the South Tahoe (Calif.) Water Reclamation Plant, the first, largest and most fully integrated plant in the world today producing water of potable quality directly from sewage effluent, began operation and has since processed one billion gallons of waste water, enough drinking water quality effluent for the annual household needs of 30,000 people. The incremental cost of discharging secondary effluent is $.166 per 1000 gallons. The stated operational cost includes carbon adsorption and regeneration at $.036 per 1000 gallons. Public resistance to the use of renovated water is lessening. Use of this type of water in long distance space flights will help increase public acceptance. According to the U. S. Public Health Service, drinking water standards do not apply to direct use of reclaimed water for drinking. Research is reportedly planned to establish the needed standards for water from heavily polluted sources. The potential benefits of purified waste water are greater than the incremental costs. The value of secondary effluent is generally nil, whereas tertiary effluent ranges in value from $.09 per 1000 gallons to the cost value of fresh water, on San Francisco peninsula, of $.18 to $.376 per 1000 gallons. The virtual elimination of biostimulants and elimination of the need for ocean outfalls with unknown effects on bay and ocean ecology can be accomplished with tertiary treatment. A simplified flowsheet of South Tahoe Water Reclamation Plant is included in the article. (Selby-Texas)
W71-01979

CURRENT STATUS OF RESEARCH ON WASTE WATER RECLAMATION IN SOUTH AFRICA,
G. J. Stander, L. R. J. Van Vuuren, and G. L. Dalton.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, March 16-20, 1970. 12 p, 3 tab, 7 fig, 8 ref.

Descriptors: Activated carbon, Coagulation, Research and development, *Waste water treatment, *Water reuse, *Reclaimed water.
Identifiers: *South Africa, Dissolved organics, Design formulation.

The efficient removal of the predominately organic impurities from waste water calls for the application of more sophisticated techniques than are normally applied in conventional water treatment. The successful operation of large-scale plants at Windhoek and Lake Tahoe have confirmed that a combination of biological, chemical and physical processes may be considered as most feasible current approach in waste water reclamation. Research conducted by the National Institute of Water Research has been focused on further refinements to some individual process units. A pilot plant was constructed in Pretoria to study the physico-chemical route for waste water reclamation. These investigations have culminated in the design and construction of a 1 million gal/day demonstration plant which will be a basis for further research on waste water reclamation in South Africa, with the main objectives of formulating design criteria for larger reclamation plants and to evaluate costs and performance data. Particular emphasis is placed on the technique developed for the application of powdered activated carbon as an integral part of the renovation process for the adsorption of dissolved organics from secondary effluents. (Selby-Texas)
W71-01980

THE APPRAISAL OF SOME SIGNIFICANT PROBLEMS IN THE REUSE OF WASTE WATER,
M. R. Henzen, and J. W. Funke.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, March 16-20, 1970. 19 p, 10 tab, 1 fig, 9 ref.

Descriptors: *Reuse, Water requirements, Dissolved solids, Water quality, Salinity, Irrigation, Recreation demand, Cooling water, Corrosion control, *Waste water treatment.
Identifiers: *South Africa, *Effluent composition, Quality requirements.

Of the total water utilized in the Republic of South Africa, about 80% is used for irrigation and stockwatering. The remaining 20%, utilized for domestic and industrial purposes, can be tapped for reclamation. A discussion of availability of waste water for reuse is presented. The quality of waste waters vary considerable depending on origin of the waters, the extent to which it has already been reused, and the degree of dilution. Several tables demonstrate the variations in quality of waste waters, including (1) increase in mineral and organic pollution of water after one cycle of use for domestic purposes, (2) typical compositions of untreated industrial effluents, (3) composition of treated municipal sewage effluents, and (4) total dissolved solids concentration. Waste water may be reused as water supply for domestic purposes, water supply for industries, as irrigation water and for recreational purposes. The relation between water quality and requirements is also discussed. From a point of view of reuse of water, there is no reason why water of highest quality should be used for cooling purposes, since concentrations of 4,000 mg/L of dissolved solids and higher can be tolerated in evaporative recirculating systems. The use of purified sewage water for irrigation has been practiced for many years without apparent deleterious effect to crops and soil. However, municipal or industrial effluents have limiting factors. Because of the wide tolerance limits of water quality for

recreational purposes the reuse of waste waters for this purpose are subject to only a few limitations. From available statistics, there appears to be much scope for a broader application of waste water reuse. (Selby-Texas)
W71-01981

ADVANCED TREATMENT OF MUNICIPAL WASTE WATERS IN THE UNITED STATES OF AMERICA,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
F. M. Middleton.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 33 p, 7 tab, 3 fig, 11 ref.

Descriptors: *Water pollution control, *Waste water treatment, Legislation, Filtration, Screens, Biochemical oxygen demand, Chlorine, Mathematical models, Optimization, Water reuse.
Identifiers: *United States, Tube settlers, Carbon removal.

Water quality standards and the implementation of water pollution control measures in the United States make it necessary to improve on municipal waste water treatment. In addition to better removal of solids sand biodegradable carbon, high removals of phosphorus and nitrogen are being required. Legislation since 1965 and the substantial funds commited to research and building treatment plants indicates the U. S. is on a positive action cause to abate pollution from treatable sources. Better solids removal can be achieved by new filtration techniques, tube settlers, screening and use of chemicals. Better BOD removal is achievable through use of pure oxygen in place of air in activated sludge plants and dissolved organics are efficiently removed by activated carbon. Ozone and light-catalyzed chlorine may be useful ways to destroy organics. Chemical treatment of raw sewage or primary effluents followed by activated carbon treatment may be an alternate to conventional secondary treatment. A variety of phosphorus removal techniques based on chemical precipitation are available. Nitrogen removal methods are not yet available on a well-tested, large scale. Mathematical models and optimization techniques being developed will provide new useful tools for plant design. (Selby-Texas)
W71-01982

MARINE EFFLUENTS RESEARCH AND MARINE DISPOSAL OF EFFLUENTS,
G. R. Atkins.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 15 p, 3 fig, 6 tab, 3 ref.

Descriptors: *Effluents, *Disposal, *Oceanography, Testing, Thermal stratification, Salinity, Ocean currents, Diffusion, Bacteria, Degradation, Coliform.
Identifiers: *South Africa, Eddy diffusion coefficient.

South African coastal authorities became concerned over disposal of effluent in a popular resort beach area of False Bay. An investigation was carried out to determine effects of effluents disposal there. Oceanographic data obtained from the area were: (1) temperature determined by bathythermograph, (2) salinity by the inductive salinometer at zero and 100 feet depths, (3) wind records from coastal installations, and (4) currents measured by dye-bombs. Diffusion tests were conducted to establish the eddy diffusion coefficient. Coliform counts were also taken. Results of all tests concluded the False Bay area was not suitable for discharge of large quantities colored, toxic wastes or raw sewage. This is because major effluent discharge would be dependent on a continual renewal of water masses. This renewal only takes place, some degree during the summer. Temperature records indicate that the water masses during summer are very stable due to density layering. Winter isotherms show significant distortion with almost zero temperature gradients, i.e., potentially unstable conditions. Current movement in the bay is slow. Due to the shallow depth water, dilution coefficients were low. With regard to conditions close inshore, deep water and reasonable current speeds were encountered only on the rocky coastlines. Discharge into small bays must be avoided due to eddy formation or sanitation. (Selby-Texas)
W71-01983

CONSIDERATIONS ON THE DESIGN OF A SEWAGE PURIFICATION PLANT TO PRODUCE AN EFFLUENT SUITABLE FOR ADVANCED PURIFICATION,
W. M. Malan.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 8 p, 1 fig.

Descriptors: *Sewage treatment, *Design, Screens, Sedimentation, Activated sludge, Aeration, Color, Costs, Flow rates, Waste water treatment, Water reuse.
Identifiers: *South Africa, *Sedimentation tanks, Sand filtration.

It was decided by a South African community to abandon a pond system in favor of a conventional sewage purification plant. A large portion of effluent was intended for reuse by a paper mill and other industries which might move in later. An activated sludge plant was selected. Design considerations included, screening and grit removal, primary sedimentation, activated sludge treatment and aeration, secondary settling and activated sludge return. The two primary sedimentation tanks were 50 feet in diameter and provide an upflow velocity of 3.3 feet per hour. Rate of nitrification for the activated sludge treatment was found to be approximately 50 mg/l per hour. Three aeration modules, each capable of treating 0.67 million gallons of settled sewage per day were built. Each module consisted of 4 concentric orbal channels, with two final settling tanks in the middle. Aeration was provided by Huisman discs driven by electric motors. Each aeration module was provided with two secondary settling tanks each 40 feet in diameter. This provides an upflow velocity of 1.8 feet per hour. Two sand filter units each 10 feet by 12 feet were provided. At an initial filtration rate of 2 gallons per square foot per minute, these filters are capable of treating the effluent from one module (.67 million gallons per day). Backwashing can take place at a rate of 12 gallons per square foot per minute. Biologically purified sewage at the community contains normally 90 to 100 color units on the Hazen scale. Present requirements of the paper mill dictate a maximum of 40 units. It was decided to decolorize by means of chlorination and if necessary to supplement this later by flocculation. Costs of establishing and operating the plant are discussed. (Selby-Texas)
W71-01984

EFFLUENT MANAGEMENT BY JUDICIOUS INTEGRATION OF VARIOUS PROCESSES AND UTILIZATION OF TREATMENT PLANT BEYOND DESIGN CAPACITY,
H. C. Blersch, and H. A. De Villiers.
Preprint, 1970 Conference of the Institute of Water Pollution Control (Southern African Branch), Cape Town, South Africa, 16-20 March 1970. 17 p, 1 tab, 17 fig, 2 ref.

Descriptors: *Waste management, *Costs, *Design, Biological treatment, Sedimentation, Flow rates, Biochemical oxygen demand, Waste water treatment, Industrial wastes.
Identifiers: *Distillery wastes, *South Africa, Design capacity, Biological filtration.

Because capital investment in waste treatment facilities is generally governed by peak loads, high, short duration seasonal peaks tend to lead to disproportionate treatment costs. Insufficient specific data on the size and responsiveness to treatment of the peak load result in conservative design criteria which increase this tendency. Described is how costs were substantially reduced in a specific case by establishing design criteria for determining, through several years' experimental operation of full scale units on proportions of the wastes received, added to domestic sewage, (1) the effects of various degrees of seasonal overload, up to very high levels, on biological filtration plant, and (2) the capacity of a large pond area to buffer the effects of consequent seasonal deterioration in plant effluent. Brief reference is also made to the application of the fact that domestic sludge digesters can accept limited admixture wastes while handling their full domestic load. (Selby-Texas)
W71-01985

FLUIDIZED BED RECOVERS PROCESS CHEMICALS,
Chicago Co., Ill.
J. E. Hanaway, Jr.
Water and Wastes Engineering/Industrial Journal, Vol 7, No 5, p C14-C15, May 1970. 1 fig.

Descriptors: *Pulp wastes, *Waste treatment, Biochemical oxygen demand, Ohio River, Inorganic compounds, Oxidation.
Identifiers: *Waste liquor, Paper wastes, Container-Copeland Process.

The Wescor Corporation pulp and paper mill in Kentucky produces about 200 tons of wood pulp per day. The volume of weak waste liquor amounts to about 800 tons per day at a total solids concentration of about 10%, and contains about 36 tons per day of BOD. Treatment in the recovery system destroys more than 99% of the BOD and recovers more than 95% of the inorganic pulping chemicals. The Container-Copeland Process for the treatment is based on high temperature oxidation of the organic matter found in the waste liquor. Because of thermal characteristics of fluidized bed oxidation and the design features in the system, the oxidation is self-supporting, in that it operates on the fuel values contained in the waste liquor at relatively low solids, as compared to other types of oxidation furnaces which require liquor concentrated to 50 or 60% solids. Fluidized-bed oxidation under these conditions presents no explosive hazards. The process steps are described in detail. The on-stream factor of the system at the Wescor mill has averaged about 95% since the start-up in June 1967. (Selby-Texas)
W71-01986

MANAGEMENT OF FARM ANIMAL WASTES.
American Society of Agricultural Engineers, St. Joseph, Mich.

For sale by the American Society of Agricultural Engineers, St. Joseph, Mich. Price: $5.00. Proceedings National Symposium on Animal Waste Management, May 1966, 161 p. Michigan State University, ASAE Publication No. SP-0366.

Descriptors: *Farm wastes, *Management, *Public health, *Water pollution sources, *Livestock, *Waste disposal, *Slurries, *Lagoons, *Biological treatment, Waste storage, Physical properties, Odor, Distribution systems, Irrigation, Labor, Environmental sanitation, Sludge treatment, Incineration, Feeds.
Identifiers: Feedlot runoff, Production, High density systems, Handling, Slatted floors, Materials, Handling, Liquid manure, Equipment design, Waste management, Oxidation ditches, Composting, Kjeldahl nitrogen, Coprophagy.

The National Symposium on Animal Waste Management had three main objectives: (1) To delineate the problem of managing animal waste, (2) To evaluate our current technology in the management of our farm wastes (technology in the farm waste management was divided into methods

of handling, treatment, utilization, and disposal) and (3) To stimulate and give new direction to future research in solid wastes management. Fifty-one papers were presented representing eighty-nine professionals - from industry, campus and government; from manufacturing, research, extension and regulatory agencies; as animal scientists, bacteriologists, economists, engineers, and sanitarians. The last three pages of the publication are devoted to ASAE recommendation (ASAE R292): Uniform Terminology for Rural Waste Management. (See also W71-01993 thru W71-02033). (Christenbury-Iowa State)
W71-01992

PHYSICAL, CHEMICAL AND BACTERIOLOGICAL PROPERTIES OF FARM WASTES (BOVINE ANIMALS),
Michigan State Univ., East Lansing.
S. A. Witzel, E. McCoy, L. B. Polkowski, O. J. Attoe, and M. S. Nichols.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, p 10-14, May 1966. 10 tab, 19 ref. USDI No. 8 RO1 SW 00042-02.

Descriptors: *Farm waste, *Waste disposal, *Cattle, *Biochemical oxygen demand, Chemical oxygen demand, Anaerobic conditions, Aerobic conditions, Hydrogen ion concentration.
Identifiers: *Lagoon flora, *Population equivalents, *Liquid manure, Liquid manure tank, Volitile solids, Plant response.

This report characterizes pollutants derived from farm animal (Bovine) waste. Wastes were collected from dairy bulls, dairy cows, and beef cattle. The wastes were analyzed for volume, suspended solids, percent BOD and COD. Further analysis show the effects of treating manure on yield and recovery of N, P, and K by corn plants. The data indicate that high concentrations of bacteria (dead or alive), volatile solids, BOD and COD are found in waste from bovine animals. The study indicated that reduction by lagoon retention, settling, aerobic or anaerobic digestion does not remove sufficient amounts of volatile solids, BOD and COD to provide safe effluent for disposal in streams. Indications are that liquid manure handling by farmers may be the most feasible approach for waste disposal. (See also W71-01992). (Christenbury-Iowa State)
W71-01993

DUCK-PROCESSING WASTE,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05B.
W71-01994

HEALTH ASPECTS AND VECTOR CONTROL ASSOCIATED WITH ANIMAL WASTES,
Public Health Service.
For primary bibliographic entry see Field 05F.
W71-01995

BIOLOGICAL INTERRELATIONSHIPS BETWEEN FECES AND FLIES,
California Univ., Berkeley.
John R. Anderson.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 20-23. 35 ref.

Descriptors: *Farm wastes, *Domestic wastes, Confinement pens, Livestock.
Identifiers: *Filth flies, *Livestock-husbandry operations, *Fly populations, Livestock production methods, High-density confinement.

This report discusses the effects on fly populations as affected by changes in livestock production methods. Field research has indicated that the foremost cause for the prodigious number of flies today is the recent widespread occurence of low-area, high-density concentrations of animals in all phases of livestock-husbandry operations. Although recent changes in livestock husbandry have created serious fly problems, the possibilities for constructively managing manure to avoid or reduce the production of flies under today's low-area, high-density confinement of animals appear much better than with previous technologies. (See also W71-01992). (Christenbury-Iowa State)
W71-01996

STORMWATER RUNOFF FROM CATTLE FEEDLOTS,
Kansas State Univ., Manhattan.
For primary bibliographic entry see Field 05B.
W71-01997

PHYSICAL PROPERTIES OF ANIMAL MANURES ASSOCIATED WITH HANDLING,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-01998

METHODS OF HANDLING POULTRY-WASTE MATERIAL,
Cornell Univ., Ithaca, N.Y. Dept. of Poultry Science.
C. E. Ostrander.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 32-33.

Descriptors: *Poultry, *Farm wastes, Waste storage, Waste disposal, Odors.
Identifiers: *Handling, High-density systems, Processing, Methods, Collecting.

This paper reports on manure handling methods employed in high-density poultry operations. Operations include: collecting, removal, storing, loading, spreading, processing and disposal. (See also W71-01992). (Christenbury-Iowa State)
W71-01999

PUMPING MANURE SLURRIES,
California Univ., Davis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02000

ENGINEERING PROBLEMS IN YEAR-ROUND DISTRIBUTION OF WASTE WATER,
Pennsylvania State Univ., University Park, Pa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02001

SLOPING FLOORS FOR BEEF-CATTLE FEEDLOTS,
California Univ., Davis.
S. R. Morrison, V. E. Mendel, and T. E. Bond.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 41-43. 3 tab, 4 fig, 3 ref.

Descriptors: *Cattle, *Farm wastes, Confinement pens, Performance, Disposal.
Identifiers: *Slatted floor, *Sloping floor, *Feedlots, Weight gains, Cattle behavior, Feed efficiency.

Limited tests on sloping floors for cattle feedlots indicate that slopes up to 7 deg do not depress weight gains or feed efficiency. A slope of about 5 deg is sufficient for removal of most of the manure, but unless some flushing arrangement is employed, manure will build up near the feed bunk. Stalls have little value in preventing this build-up. A slat-covered pit at the lower end of the slope allows manure to move freely off the floor and serves as a satisfactory storage. (See also W71-01992). (Christenbury-Iowa State)
W71-02002

MATERIALS HANDLING AND LABOR IN FREE-STALL AND LOOSE HOUSING,
Purdue Univ., Lafayette, Ind.
W. E. Schmisseur, C. M. Brown, Jr., J. L. Albright, W. M. Dillon, and A. C. Dale.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 43-45. 3 tab, 17 ref.

Descriptors: *Farm wastes, *Cattle, Disposal, Labor.
Identifiers: *Materials handling, *Free-stall, *Loose housing, Bedding.

In the winter and spring of 1964-65 Purdue University conducted two 6-month studies in Lafayette and Cuzco, Indiana, comparing free-stall to loose housing. For one free-stall comparison, 20 stalls were place in one-third of the area of each of two pole-type barns. The remaining areas were used for loose housing. Ninety cows were divided into four individual lots. Each free-stall unit housed 20 cows, with 25 cows in loose housing. All four lots were treated and handled similarly. Straw was used as bedding. Daily work sheets showing time used to bed the cows, scrape alleys, pounds of bedding used, and the pounds of manure removed daily were kept on all groups. Two pole-type barns were also used in the other free-stall comparison. One barn was used for loose housing; the other contained 32 free stalls; 26 animals were housed in each barn. Sawdust was used to bed all animals for half of the experiment; straw was used for the rest of the experiment. (See also W71-01992). (Christenbury-Iowa State)
W71-02003

CATTLE-MANURE HANDLING AND DISPOSAL SYSTEMS ON THE WEST COAST,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02004

MACERATION FOR DISPOSAL OF DEAD POULTRY,
California Univ., Davis. Dept. of Agricultural Engineering.
J. A. Moore, and W. C. Fairbank.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 47-49. 2 fig, 2 ref.

Descriptors: *Farm wastes, Disposal, Farm lagoons, Septic tanks, *Waste disposal, *Poultry, Equipment slurries.
Identifiers: *Macerator, Composting, Thin bed drying, *Equipment design.

The development of a macerator for dead poultry is reported. Several initial designs were investigated. Combining all the findings of the preliminary investigation in the final design of the second chopper-type macerator has led to the development of a satisfactory dead-bird macerator. Systems for disposal of the macerated poultry are discussed and evaluated. Slurry systems, lagoons, heated septic tanks, artificial composting, and thin bed drying were judged to be satisfactory for disposing fo the macerated poultry. (See also W71-01992). (Christenbury-Iowa State)
W71-02005

WATER METABOLISM STUDIES MAY ASSIST WITH WASTE DISPOSAL,
Texas A and M Univ., College Station. Dept. of Poultry Science.
J. H. Quisenberry, D. D. Malik, and Ramon Ibarbia.

Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 49-51. 10 tab.

Descriptors: *Farm wastes, *Poultry, Waste disposal, Odor, Clays, Bentonite, Genetics, Confinement pens, Eggs diets.
Identifiers: Waste management, Water excretion, Drippings, Laying bird.

For many poultry operations, attempts to solve the waste-management problems can best be accomplished by concentrating on methods of obtaining dry or drying the droppings to a manageable level. Three methods have been tested and were reported in this paper. These are: (a) use of splashboards under cage operations, (b) genetic selection for low water excretors. Each of these has its appropriate place in bird management and should be used by poultrymen as their specific needs require. (See also W71-01992). (Christenbury-Iowa State)
W71-02006

DISPOSAL OF POULTRY MANURE BY PLOW-FURROW-COVER METHOD,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Agricultural Engineering.
Charles H. Reed.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 52-53. 1 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, *Waste disposal, Odor, Slurries, Furrows, Soil disposal fields.
Identifiers: *Waste management, *Plow cover, Liquid manure, Flies.

The disposal of liquid manure by the plow-furrow-cover technique appears to be an excellent conservation method. The upper soil layer is used as the disposal medium; there is no opportunity for flies to breed or even feed. In a closed handling system there are no detectable odors. With this method from 1 to 2 in. of slurry is deposited in a plowed furrow 6 to 8 in. deep. Immediately after deposition, a single-bottom plow covers the manure, making the next furrow; this can be done in one or two operations. Depositing and completely covering 2 in. of slurry, equivalent to 225 tons per acre, has been very successful. This paper describes the development of the method, the initial disposal programs, and the proposed experimental program to determine the maximum rate of disposal on a limited land area. (See also W71-01992). (Christenbury-Iowa State)
W71-02007

DISPOSAL OF HOUSEHOLD WASTES IN THE SOIL,
Southern Illinois Univ., Carbondale; and Ohio State Univ., Columbus.
J. H. Jones, and G. S. Taylor.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 53-55. 1 tab, 2 fig, 5 ref.

Descriptors: *Farm wastes, *Septic tanks, *Sewage disposal, *Conductivity, Soil disposal fields, Sewers, Construction, Absorption, Rural areas.
Identifiers: *Soil absorption, *Soil clogging, Household wastes.

Generally the most satisfactory method of disposing of human excreta and household wastes in rural areas is the septic tank soil sbsorption system. While studies show that this is a safe system of household wastes disposal, many systems are malfunctioning; a high percentage of these failures is due to soil absorption difficulties. Thus the utility of the system depends on the size of the absorption field, the waste load, soil conditions, and the construction and installation of the absorption field. This paper discussed the criteria that should be used when designing a septic-tank system. The factors affecting the satisfactory operation of the system are presented. Construction and installation practices are examined. Conditions affecting soil clogging are presented along with conductivity vs cumulative outflow graphs. (See also W71-01992). (Christenbury-Iowa State)
W71-02008

REQUIREMENTS FOR MICROBIAL REDUCTION OF FARM ANIMAL WASTES,
South Dakota State Univ., Brookings. Dept. of Bacteriology.
Edward C. Berry.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 56-58. 2 tab, 1 fig, 13 ref.

Descriptors: *Farm wastes, *Lagoons, *Biodegradation, *Sewage bacteria, Odor, Anaerobic conditions, Aerobic conditions, E. coli, Bacteria, Fungi, Actinomycetes, Protozoa, Algae.
Identifiers: *Chemical environment, *Physical environment, Phage, Fermentor, Facultative, Microaerophilic, Inoculation.

The cardinal principle on which all sanitation reduction work is based is to provide an environment in which the micro-organisms can bring about conversion of undesirable material to a non-offensive and stable state in the shortest possible time. To bring this about it is necessary to consider (a) the wastes we want reduced and their end products and (b) the organisms that we want to perform this chore for us. The micro-organisms involved in manure reduction are to be found in the following groups: (a) bacteria (aerobic, anaerobic, microaerophilic, facultative or obligate), (b) fungi, (c) actinomycete, (d) protozoa, (e) algae, and (f) phage. Each organism finds its optimum environment under fairly restricted environmental conditions. This paper gives examples of the most common micro-organisms and the effect the environment has on their activity. (See also W71-01992). (Christenbury-Iowa State)
W71-02009

AEROBIC TREATMENT OF SWINE WASTE,
Illinois Univ., Urbana.
R. L. Irgens, and D. L. Day.
Laboratory study is reported in more detail in 'Journal of Agricultural Engineering Research', 11: (1) 1-10, 1966, R. L. Irgens and D. L. Day.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 58-60. 8 fig, 3 tab.

Descriptors: *Farm waste, *Aerobic treatment, *Aeration, Biochemical oxygen demand, Chemical oxygen demand, Oxidation.
Identifiers: Swine waste, Waste collection pits, Slotted-floor, Oxidation ditch.

From the results of these tests, it was calculated that for aerobic stabilization of the waste, about 6 cu. ft. of tank volume per pig would be required and approximately 1.2 lb 02 per lb of BOD (0.65 lb BOD per 125-lb pig per day), or 2500 cu. ft. of air pen lb of BOD at 3 per cent efficiency of oxygen utilization. The aerobic process for treating swine waste is odor-free and does not attract flies. The only gas that is produced is carbon dioxide which to a large extent will remain in solution as bicarbonate. The organic matter that is not oxidized to carbon dioxide and water is converted to stable solids, which are easily dewatered and dried on a sand bed. The effluent has a low BOD and is free from ammonia. It seemed feasible to develop an oxidation ditch inside a swine production bulding utilizing self-cleaning slatted floors. (See also W71-01992). (Christenbury-Iowa State)
W71-02010

OPERATING CHARACTERISTICS OF TWO AEROBIC-ANAEROBIC DAIRY MANURE TREATMENT SYSTEMS,
Massachusetts Univ., Amherst. Dept. of Agricultural Engineering; and New Holland Machine Co., Pa.
N. W. Webster, and J. T. Clayton.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 61-65. 2 tab, 14 fig, 20 ref. USDI water research act of 1964 (Public Law 88-379).

Descriptors: *Farm wastes, *Anaerobic conditions, *Aerobic conditions, *Aeration, Sedimentation, Dissolved oxygen, Biochemical oxygen demand.
Identifiers: *Dairy manure, Aerators, Aeration tanks, Sedimentation tanks, Systems, Volatile solids.

Two aerobic waste-treatment systems were designed and tested for use in treating dairy manure. The systems were combinations of aeration and settlement for the purpose of reducing the pollution capabilities of the waste and to make it possible to use the treated effluent for transporting the fresh waste. The system utilizing anaerobic primary settlement and secondary aeration system was selected as the best suited for agricultural use. A system using primary aeration with secondary settlement did not operate satisfactorily. (See also W71-01992) (Christenbury-Iowa State)
W71-02011

ON-SITE COMPOSTING OF POULTRY MANURE,
Auburn Univ., Ala. Dept. of Agricultural Engineering.
J. R. Howes.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 68-69.

Descriptors: *Farm wastes, *Poultry, *Aerobic conditions, Microorganisms, Peat, Cellulose, Aerobic treatment.
Identifiers: *Composting, Fecal material, *Litter, Heat of composting, *Litterlife.

Although composting dates back to antiquity, the composting of poultry litter in situ is new. A culture of 46 species of micro-organisms was mixed into a base of peat and various minerals. This active mixture was spread at the rate of 1/2 lb. per sq. ft. on poultry litter that was at least 6 in. deep and contained an appropriate balance of cellulose and fecal material. Water used to clean the house interior was added to the litter and then mechanically mixed to initiate aerobic action. After heat of composting had subsided, birds were placed on the litter. This process is relatively inexpensive. It overcomes problems associated with obtaining and disposing of litter; provides odor and fly-free environments; permits birds to be safely replaced on the same litter shortly after diseased stock has been removed or the houses flooded; permits humidification of poultry houses; keeps dust to a minimum and enables house interiors to be washed, thus increasing sanitation and equipment efficiency. (See also W71-01992) (Christenbury - Iowa State)
W71-02013

PRIMARY TREATMENT OF SWINE WASTES BY LAGOONING,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
T. L. Willrich.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 70-74. 2 fig, 7 tab, 14 ref. U. S. Public Health Research Grant EF00410.

Descriptors: *Farm wastes, *Anaerobic conditions, *Design criteria, *Performance, Lagoons, Anaerobic bacteria, Chromatium, Rhodothece, Odor, Gases, Sludge.

Identifiers: *Sludge accumulation, *Swine wastes, *Waste treatment lagoons, *Anaerobic lagoons, Micro lagoons, Lagoon feeding, Gas production, Odor production.

A brief history of lagooning at Iowa State University is presented. The design and problems associated with operation of the lagoon are presented. Data was taken over a period of 8 years to arrive at recommendations for construction of lagoons. Factors discussed include: detention times and sludge accumulations, loading rates, lagoon performance, gas production, odor production, micro-lagooning, lagoon feeding, and design criteria. The recommended design criteria are: (1) For anaerobic lagoons which will receive fairly uniform and frequent (one-a-week or less) loadings: allow a minimum of 1 cu. ft. of lagoon water volume per pound of total animal weight confined in a hog-finishing building, plus additional lagoon volume for sludge storage. (2) For lagoons which will recieve non-uniform and intermittent loading: allow a minimum of two cu. ft. of lagoon water volume per pound of total animal weight confined in a hog-finishing building, plus additional lagoon volume for sludge storage. (See also W71-01992) (Christenbury-Iowa State)
W71-02014

DESIGN CRITERIA FOR ANAEROBIC LAGOONS FOR SWINE MANURE DISPOSAL,
Nebraska State Dept. of Health, Lincoln.
David R. Curtis.
Proceedings National Symposiun on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 75-80. 5 fig, 5 tab.

Descriptors: *Farm wastes, *Anaerobic conditions, *Chemical oxygen demand, *Biochemical oxygen demand, *Odor, *Hydrogen ion concentration, Lagoons, Temperature, Oxidation-reduction potential, Alkalinity.
Identifiers: *Kjeldahl nitrogen, *Volatile acids, *Swine waste, Anaerobic lagoons.

On-site investigations were conducted at 10 selected lagoons to confirm data collected through questionnaires and to observe the actual operation. Data collected included: Number of swine served, sketch of the plan and elevation views, chemical data on samples collected at various times during the study, and a typical cross section of the lagoons showing how solids have accumulated. The temperatures in the lagoons ranged from 70 to 80 F, with temperatures of 75 F and above more prevalent. Oxidation reduction potential (ORP) data indicated that anaerobic conditions were present at all times in the lagoons. Chemical analyses have proved to be effective diagonostic instruments in evaluating the probable cause of objectional odors from lagoon installations. The determinations of greatest significance were pH, Kjeldahl nitrogen, volatile acids, alkalinity, BOD and COD. Design criteria for hog lagoon installations for Nebraska are given. Operational procedures are outlined that should improve the chances for successful lagoon operations. (See also W71-01992) (Christenbury-Iowa State)
W71-02015

CATTLE-MANURE TREATMENT TECHNIQUES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
R. W. Agnew, and R. C. Loehr.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 81-84. 1 fig, 5 tab, 10 ref.

Descriptors: *Farm wastes, *Lagoons, *Anaerobic digestion, *Aeration, Activated sludge, Solid wastes, Runoff, Chemical oxygen demand, Biochemical oxygen demand, Laboratory tests, Alkalinity.
Identifiers: *Waste characteristics, *Polishing unit, *Anaerobic lagoons, *Aeration systems, Settled solids, Solids handling, Solids disposal, Runoff control, Volatile acids, Kjeldahl nitrogen.

The characteristics of commercial lagooning operations were discussed. It was pointed out that there was a need for extensive planning in the design and operation of lagoons. It was suggested that a combination of an anaerobic lagoon and an aeration unit may be most practical for most installations. Data was presented and discussed concerning the characteristics of anaerobic lagoons, aeration systems, and the settled solids. A potential treatment facility was proposed and discussed as to the cost, colids handling, solids disposal, efficiency, and runoff control. (See also W71-01992) (Christenbury-Iowa State)
W71-02016

DEWATERING CHICKEN MANURES BY VACUUM FILTRATION,
Clarkson Coll. of Technology, Potsdam, N.Y., and New York State Dept. of Health, Albany.
E. A. Cassell, A. F. Warner, and G. B. Jacobs.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 85-91. 5 tab, 9 fig, 32 ref. N.Y. State Dept. of Health (Contract No. C-18768).

Descriptors: *Farm wastes, *Sludge treatment, *Poultry, *Dewatering, Laboratory tests, Sewage sludge, Filtration, Municipal wastes.
Identifiers: *Sludge conditioners, *Vacuum filtration, Chemical-sludge conditioners, Conditioner dosage, Liquid requirements, Solids demand.

The sludge conditioning and vacuum filtration characteristics of sewage sludges and chicken manures were found to be vastly different. Most of the sewage sludges were dewatered with FeC13, FeC13 and lime conbinations, cationic polyelectrolyte, and non-ionic polyelectrolyte sludge conditioners. None of these effectively promoted the dewatering of chicken manures. On the other hand, the anionic polyelectrolyte effectively dewatered chicken manure, but not the sewage sludges. The anionic polyelectrolyte can reduce the specific resistance of chicken manures by as much as a factor of 15 and produce filter cakes with as high as 25 percent total solids. (See also W71-01992) (Christenbury-Iowa State)
W71-02017

REMOVAL OF MOISTURE FROM POULTRY WASTE BY ELECTRO-OSMOSIS (PART I),
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
Otis E. Cross.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 91-93. 7 fig.

Descriptors: *Farm wastes, *Dewatering, *Electro-osmosis, Laboratory tests, Cathodes, Poultry.
Identifiers: Moisture distribution, Expelling water.

This investigation was designed to determine the effectiveness of expelling water from poultry excrement by the electro-osmosis phenomena. Three factors were selected as being the most critical: amount of electric current, time, and distance between electrodes. Twelve plastic tubes were placed in a horizontal position. Each tube was 2 in. ID and 65 cm. long. The piston-type anode was carbon and maintained constant pressure upon the excrement sample by means of a weighted-lever arrangement. The cathode was a 1 mm. copper screen. The tests were conducted with three sample lengths: 40, 25, and 10 cm. The electro-osmosis phenomena produced a 57 percent decrease in moisture content. The amount of expelled water was a function of current flow, time, length of sample, and moisture content of the sample. (See also W71-01992) (Christenbury-Iowa State)
W71-02018

REMOVAL OF MOISTURE FROM POULTRY WASTE BY ELECTRO-OSMOSIS (PART 2),
Michigan State University, East Lansing. Dept. of Agricultural Engineering.
F. V. Nurnburger, C. J. Mackson, and J. Davidson.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 93-95. 7 fig.

Descriptors: *Farm wastes, *Electro-osmosis, *Dewatering, Poultry.
Identifiers: *Joule heating, *Gravity flow, Current flow.

This investigation was undertaken to study the effects of various electrode materials on the liquid expelled from chicken excrement by the process of electro-osmosis. It utilized the effects of joule heating and gravity flow. The results from using 5, 10, 15, and 20 v d-c were that 20 v d-c gave the best results. Of the three materials used, stainless steel gave the best performance, copper was the poorest, and steel was intermediate. The maximum moisture-content reduction was 4.8 percent wb based on 22 hr. of operation at 20 v. This was not sufficient to reach a pelletable level from the initial value of 80 percent wb. The cost of the electric energy used was 12.7 cent per gallon of liquid removed based on the rate of 2 cent per Kw-hr. (See also W71-01992) (Christenbury-Iowa State)
W71-02019

DESTRUCTION OF CHICKEN MANURE BY INCINERATION,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel, and D. C. Ludington.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 95-98. 2 tab, 4 fig, 12 ref. N.Y. State Department of Health (Contract No C18965).

Descriptors: *Farm wastes, *Incineration, Poultry, Laboratory tests, Heat balance, Natural resources.
Identifiers: *Combustion, *Solid fuels, Volatile solids, Mass balance, Fixed carbon, Ash, Heat of combustion, High heat value, Low heat value, Energy balance.

The volatile solids in chicken manure represents considerable energy. Incineration is a process which utilizes this energy for destruction of the organic portion of the manure. The application of existing combustion theory to the incineration of chicken manure is difficult beacuse of lack of basic property information and the variability of the material. The incineration process is very dependent on the moisture content of the manure. A laboratory incinerator has been constructed to investigate the incineration process. Initial trials of the incinerator have been restricted to partially dried manure. Considerable information has been obtained. Future application of incineration will depend on cost factors and possible air pollution hazards. A mass and heat balance for a typical incineration trial is given in an Appendix to the paper. (See also W71-01992) (Christenbury-Iowa State)
W71-02020

TREATMENT OF DUC. WASTES AND THEIR EFFECTS ON WATER QUALITY,
Virginia State Water Control Board, Richmond.
R. V. Davis, C. E. Cooley, and A. V. Hadder.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 98-105, 10 tab, 7 ref.

Descriptors: *Farm wastes, *Coliforms, *Poultry, *Oysters, *Water quality, Salmonella, Biochemical oxygen demand, Environmental effects, Settling basins.
Identifiers: *Rappahannock River, Pilot pond, Barnhardt Farms, Inc., MPN (Most probable number), Raw wastes, Duck run.

Early in 1963 a six-month study was undertaken to determine the effect of coliform organisms in the treated wastes from two duck farms on water quality in an oyster-producing and recreational area of the Rappahannock River near Urbanna, Virginia. Before the treatment facilities were installed, water quality in the area was questionable for recreation purposes and was restricted for direct marketing of shellfish. Treatment consists of alternately used earthen settling basins for removing solids, followed by 4-day retention earthen basins. These remove essentially all settleable solids and reduce the most probable number of coliform organisms per 100 ml. by 90 to 95 percent. On the basis of data collected from the river, restrictions from the public oyster beds were lifted. Satisfactory recreational water quality now exists throughout the area, except very near the discharges. (See also W71-01992) (Christenbury-Iowa State)
W71-02021

VALUE OF BROILER LITTER AS FEED FOR RUMINANTS,
Virginia Polytechnic Inst., Blacksburg; Cornell Univ., Ithaca, N.Y.; and Kansas State Univ., Manhattan.
J. P. Fontenot, A. N. Bhattachanya, C. L. Drake, and W. H. McClure.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 105-108. 7 tab, 11 ref.

Descriptors: *Farm wastes, *Poultry, *Sheep, *Cattle, *Feeds, Proteins, Metabolism, Ruminants, Feeding rates.
Identifiers: Nutritive value, Broiler litter, Digestible protein, Digestible energy, Metabolizable energy, Total digestible nutrients, Carcass grade, Rate of gain.

Information has been presented concerning the nutritive value of broiler litter for ruminants. The litter samples analyzed contained an average of 32 percent crude protein, dry basis. In autoclaved litter, true protein accounted for 45 percent of the total nitrogen. In metabolism trials with wethers, 25 and 50 percent autoclaved peanut-hull and wood-shaving broiler litters replaced corresponding amounts of a corn-hay ration. There were no significant differences in digestible protein, digestible energy, metabolizable energy, and TDN content between kinds and levels of litter. Average values were 22.7 percent, 2440 kcal per kg, 2181 kcal per kg, and 59.8 percent, respectively. It was found in fattening trials that rate of gain and carcass grade were not significantly different for beef steers fed mixtures containing 25 percent ground peanut-hull or wood-shaving broiler litter than for those fed a conventional fattening mixture. (See also W71-01992) (Christenbury-Iowa State)
W71-02022

UTILIZATION OF ANIMAL WASTE AS FEED FOR RUMINANTS,
Auburn Univ., Ala. Dept. of Animal Science.
Aw. brady Anthony.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 109-112. 13 tab, 23 ref.

Descriptors: *Farm wastes, *Cattle, *Chemical analysis, Feeds, Silage, Nutrients, Amino acids, Vitamins.
Identifiers: *Feedlot manure, *Steers, *Digestion coefficients, *Average daily gain, Manure, Carcass data.

Analysis of feedlot manure showed it to be a valuable source of vitamins and amino acids. Washed manure was mixed with a concentrated feed and successfully fed to steers. When unwashed manure was combined with a concentrated mixture or with silage and fed to steers, animal gain and feed efficiency were not improved. Fresh feedlot manure proved to be a valuable ration component when it was either washed or autoclaved. Fresh feedlot manure was blended with coastal bermudagrass hay to make a palatable and nutritious low-moisture silage. (See also W71-01992) (Christenbury-Iowa State)
W71-02023

COPROPHAGY AND USE OF ANIMAL WASTE IN LIVESTOCK FEEDS,
Texas Tech. Univ., Lubbock.
R. M. Durham.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 112-114. 6 tab.

Descriptors: *Farm wastes, *Feeds, *Livestock, Poultry, Cattle, Catfishes, Sheep, Swine, Eggs.
Identifiers: *Coprophagy, *All-concentrate ration, Feedlot steers, Digestion coefficient.

This paper reports observations of coprophagy in cattle consuming an all-concentrate ration and the feeding of rations containing manure from these cattle to poultry, cattle, swine and catfish. The all-concentrate ration was composed of 89% ground milo, 10% cottonseed meal and 1% vitamin-mineral supplement. The manure was ground in a hammer mill without prior drying and mixed with other ration ingredients for feeding. Coprophagy has been observed in cattle consuming limited quantities of the all-concentrate ration. All-concentrate cattle manure has been successfully fed to growing pullets and laying hens. The all-concentrate manure has been fed to feedlot steers with generally favorable results to limit feed consumption. Catfish can make rapid gains on feedlot manure if care is taken to prevent oxygen depletion. (See also W71-01992) (Christenbury-Iowa State)
W71-02024

ROLE OF THE RENDERER IN THE USE AND DISPOSAL OF ANIMAL WASTES,
Triangle E By-Products Co., Harrisonburg, Va.
E. L. Foerster, Sr.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 114-117.

Descriptors: *Farm wastes, Poultry, Cattle, Chemical analysis, Economics, Disposal, Equipment, Digestion tanks, Nutrients.
Identifiers: *Rendering, *Fallen stock, Protein content, Coprophagy.

Mr. Foerster gives a general history of the rendering industry in the United States. He explains the role of the industry in disposing of fallen animals. He gives an analysis for a typical product from a rendering plant. Some data is presented concerning the economics of the rendering process. Through cooperation, the rendering plant can provide a useful and efficient service in disposing of fallen stock. (See also W71-01992) (Christenbury-Iowa State)
W71-02025

EVALUATING ADAPTABILITY OF PASTURE GRASSES TO HYDROPONIC CULTURE AND THEIR ABILITY TO ACT AS CHEMICAL FILTERS,
Agricultural Research Service, Beltsville, Md.; and Maryland Univ., College Park.
Harry J. Eby.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 117-120. 6 fig.

Descriptors: *Farm wastes, *Hydroponics, *Effluents, Nutrients, Municipal wastes, Lagoons, Grasses, Aquatic environment, Root development, Light penetration.
Identifiers: Plant-nutrient removal percentage, Fertilizer value, Nutrient extraction potential, Surface area.

The possibility of using hydroponics as a means of removing nutrients from sewage-treatment plants and lagoons is discussed. Several grasses were studied with rye and tall fescue showing the most promise. Data is presented in graph form showing the plant-nutrient removal percentages. Two appendices are given. Appendix I shows the projected yield capabilities of the various forage grasses with the nutrient-extraction potential based on laboratory-scale sampling. Appendix II shows the method for computing the size of the hydroponic system required for any given volume of effluent. (See also W71-01992) (Christenbury-Iowa State)
W71-02026

PROBLEMS OF CATTLE FEEDING IN ARIZONA AS RELATED TO ANIMAL-WASTE MANAGEMENT,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
Thomas M. Stubblefield.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 120-122. 11 ref.

Descriptors: *Farm wastes, *Cattle, *Legal aspects, Relocation, Area development, Odor, Arizona.
Identifiers: *Cowtowns, *Feedlots, Metropolitan areas, Manure.

Problems associated with locating large numbers of cattle near metropolitan areas are discussed. The particular problems with large feeders in Arizona and their solutions are presented. Feedlot manure selling for as high as $5 per ton in the 1940's now is a liability costing $1 to $1.50 per ton to remove. It has been advantageous for the feedlots to relocate near farming areas for more efficient disposal of the manure. To circumvent problems with residential areas, 'cowtowns' are being developed. (See also W71-01992) (Christenbury-Iowa State)
W71-02027

ECONOMIC EVALUATION OF LIQUID-MANURE DISPOSAL FOR CONFINEMENT FINISHING OF HOGS,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05E.
W71-02028

ECONOMICS OF LIQUID-MANURE DISPOSAL FROM CONFINED LIVESTOCK,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.
W. H. M. Morris.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 126-131. 6 tab, 1 fig, 16 ref.

Descriptors: *Farm wastes, *Cost analysis, *Disposal, *Value, *Nutrients, Chemical oxygen demand, Biochemical oxygen demand, Cost comparison, Economic feasibility, Economics, Anaerobic conditions, Aerobic treatment, Liquid wastes, Irrigation.
Identifiers: *Production model, Losses in storage, Value of manure, Utilization, Oxidation ditches.

Some of the problems in estimating the costs and returns from handling manure have been discussed. Removal of the manure from the livestock production areas has not been discussed. In general, the scale and efficiency of the operation and prevention of dilution of the manure determine if the manure can be spread in the fields at a cost equal to or less than the value of the nutrients used by the crop. Aerobic and anaerobic treatment of manure in special low-cost facilities designed for use on the farm seem to be practical solutions. No profitable method of industrial utilization of livestock manure can be forseen. (See also W71-01992) (Christenbury-Iowa State)
W71-02029

POULTRY MANURE MARKETING,
Pennsylvania State Univ., University Park.
Herbert C. Jordan.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 132-133.

Descriptors: *Farm wastes, *Marketing techniques, Fertilizers, Poultry analysis, Value, Economics.
Identifiers: *Bagging, *Processing.

A survey was conducted between 1961 and 1963 concerning marketing poultry manure. Information concerning the following topics was collected: General, Bagging Manure, Processing, Supplemental Mixture, and Marketing. Cost associated with bagging and minimum analysis (nitrogen, phosphoric acid, potash) is given for bags ranging from 2.5 to 80 pounds per bag. A summary of the data is presented pointed out that fresh manure is worth about $5 a ton to the soil ($20 per ton on a dry weight basis). Poultry manure used as an organic soil conditioner is and perhaps will remain the greatest and most common use of poultry manure. (See also W71-01992) (Christenbury-Iowa State)
W71-02030

FARM-WASTE MANAGEMENT TRENDS IN NORTHERN EUROPE,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
E. P. Allred.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 133-136. 1 fig.

Descriptors: *Farm wastes, *Disposal, Equipment.
Identifiers: *Northern Europe, Family-size farm, Oxidation ditches, Disposal practices.

Farmers throughout most of northern Europe are faced with many of the same waste-disposal problems as those confronting American farmers. Methods and equipment used for waste disposal are discussed with emphasis on the 'family-size' farm. Those individuals working with oxidation ditches are quite optimistic with its performance. When one compares rural waste-disposal practices in Europe with those in America, there are noticeable differences in both equipment and methods. Surprisingly the greatest differences occur, however, in the people themselves and their attitude toward rural waste disposal. (See also W71-01992). (Christenbury-Iowa State)
W71-02031

PLANT RESPONSE TO MANURE NUTRIENTS AND PROCESSING OF ORGANIC WASTES,
Forschungsanstalt fuer Landwirtschaft, Brunswick (West Germany).
Cord Tietjen.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 136-140. 3 tab, 9 fig, 12 ref.

Descriptors: *Farm wastes, *Liquid wastes, *Nutrients, Urine, Nitrogen cattle, Swine, Fertilizers.
Identifiers: *Gulle, *Plant response, Plant nutrients, Manuring, Feces.

To produce gulle (liquid manure) from cattle feces and to apply it for manuring, the grassland has for a long time been the common way of disposal of animal waste in the Alpine foreland. New labor-saving barn arrangements, tools and implements promote the practice of gulle utilization both for grassland and cropland. It was learned by field and pot experiments that gulle can exert a strong influence on plant growth. The physiological efficiency of gulle nitrogen is several times higher than that of nitrogen in common barnyard manures. Range of variation is great depending on gulle processing and composition. Quality of manure, its contents and ratio of plant nutrients depend on kind of animals, individual properties of animals, feeding, dilution by water or other additives, barn arrangement, collection and storage facilities. It is recommended that animal excrement be processed to a standardized manure - a full gulle that can be characterized by its ratio of plant nutrients. (See also W71-01992). (Christenbury-Iowa State)
W71-02032

BIOLOGICAL TREATMENT OF ANIMAL WASTES,
Netherlands Rijkswaterstaat, Arnhem.
Henri M. J. Scheltinga.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 140-143. 7 tab, 3 fig, 10 ref.

Descriptors: *Farm wastes, *Activated sludge, *Biological treatment, Swine, Laboratory tests, Nitrogen, Cost, Biochemical oxygen demand.
Identifiers: *Nitrogen balance, *Holland, *Oxidation ditch, Nitrification, Bio-industries.

This paper discussed treatment of farm wastes in Holland. Chemical and mechanical treatment alone have not proven satisfactory. Laboratory and full scale treatment experiments have been conducted. Aeration, anaerobic decomposition, activated sludge treatment, and oxidation ditch experiments have been performed. Foaming has been experienced in some tests. Nitrification and nitrogen balance for farm wastes are discussed. The cost associated with the treatment facilities were considered. (See also W71-01992). (Christenbury-Iowa State)
W71-02033

THE EFFECTS OF FARMYARD MANURE ON MATRIC SUCTIONS PREVAILING IN A SANDY LOAM SOIL,
National Vegetable Research Station, Wellesbourne (England).
P. J. Salter, G. Berry, and J. B. Williams.
Journal of Soil Science, Vol 18, No 2, 1967, p 318-328. 3 fig, 2 tab, 25 ref.

Descriptors: *Farm wastes, *Soils, *Soil moisture, Field capacity, Wilting point, Equations.
Identifiers: *Soil matric suctions, Ryegrass, Available-water capacity, Moisture characteristic.

Soil matric suctions under a crop of ryegrass on farmyard manure-treated and untreated plots were determined over a total period of 24 weeks from March to November. The soil moisture characteristic of each plot was determined five times throughout this period, and for each plot and on every occasion a linear relationship was found between moisture content and log matric suction. A formula was derived to account for the seasonal changes in moisture characteristic - and it was then possible to obtain matric suction values from the soil moisture contents obtained from twice-weekly sampling of each plot. Although differences between available-water capacity of the manured and unmanured plots were small throughout the 6-month period of sampling, the soil matric suctions of the manured plots were almost always lower than those of the unmanured plots. The lower suctions prevailing in the manured soil could be a factor contributing to the higher yields of ryegrass obtained from the manured plots as compared with those obtained from the unmanured plots. (White-Iowa State)
W71-02034

STREAM ENRICHMENT FROM FARM OPERATIONS,
Wisconsin Univ., Madison.
Neal E. Minshall, Stanley A. Witzel, and Merle S. Nichols.
Journal of the Sanitary Engineering Division, Proceedings of ASCE, Vol 96, No SA2, April 1970, p 513-524. 2 fig, 5 tab, 4 ref.

Descriptors: *Farm wastes, *Fertilizers, *Runoff, Nitrogen, Phosphorus, Potash, Wisconsin, Water pollution, Nutrients, Precipitation, Rates of application, Corn, Frozen ground.
Identifiers: *Nutrient losses, Collection tanks.

In order to obtain information on the amount of fertilizer materials lost in runoff water from farm lands under cultivation, eight plots, 10x40 ft. in size, were established on the University of Wisconsin Agricultural Experiment Station Farm near Lancaster, Wisconsin. Investigations involving fertilizer and manure applications and losses in surface runoff were begun in 1966 and were continued through 1969. Each plot was completely surrounded by a galvanized metal border which prevented surface runoff from entering or leaving the plots, located on a 10% to 12% slope. Runoff was collected in a trough at the lower end and funneled to a measuring tank. Manure was applied at the rate of 15 tons per acre in the winter and spring. Later corn was planted in 30 inch rows on the contour. Up to 20% of N, 13% of P, and 33% of K nutrients in winter applied manure, on frozen ground, may be lost under conditions favoring maximum early spring runoff. Nutrient losses in surface runoff from plots having manure applied in the summer and incorporated into the soil were less than from check plots, which received no manure. (White-Iowa State)
W71-02035

MANURE MANAGEMENT - COSTS AND PRODUCT FORMS,
Los Angeles County Agricultural Extension Service, Calif.
J. Van Dam, and C. A. Perry.
California Agriculture, Vol 22, No 12, December 1968, p 12-13. 2 tab, 2 fig.

Descriptors: *Farm wastes, *Cattle, *Marketing, *Costs, Volume, Profit, Management.
Identifiers: *Feedlots, *Processing plant, Stockpiles, Packaging, Bulk, Pulverizer, Product forms, Delivery, Removal.

A study to determine the actual cost of removal and disposal of manure from a beef feedlot in Los Angeles County was completed by the Agricultural Extension Service. Manure was prepared for marketing in three basic forms and sold under four pricing conditions. Manure processing, packaging and marketing began with the mounding of the manure in the corrals followed by its removal to a compost stockpile. Manure was allowed to cure in a compost pile at least six months before processing. The manure could then be marketed unprocessed as composted manure; marketed processed as composted bulk; and marketed processed as composted packaged manure. The combined fixed and variable costs per cubic yard amounted to 10.5 cents for the unprocessed product, 65 cents for the processed bulk and $1.88 for the packaged processed form. The weighted average price received per cubic yard was $3.80 for the packaged, $2.40 for the processed bulk, and $1.40 for the unprocessed bulk manure. A livestock feedlot operator can probably make a profit from the sale of manure. (White-Iowa State)
W71-02037

OXIDATION DITCHES FOR WASTE DISPOSAL,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Donald L. Day.
International Journal Of Farm Building Resources, No 2, December 3, 1968, p 2-7. 9 fig, 9 ref.

Descriptors: *Farm wastes, *Hogs, *Biochemical oxygen demand, *Rotors, Foaming, Sludge, Effluent, Odors, Carbon dioxide, Oxygen, Depth, Dissolved oxygen, Electric power, Electric power costs, Volume, Velocity.
Identifiers: *Oxidation ditch, Population equivalent, Suspended solids, Slatted floors, Extended aeration.

The oxidation ditch is an efficient low-cost process for the treatment of municipal waste. It has several aspects that seem desirable for use in confinement livestock waste-treatment systems. The aerobic method is an odorless process with final products of water, carbon dioxide, and stable minerals. The oxidation ditch can be integrated into a self-cleaning slatted floor system. However, control of foaming is an immediate problem that must be solved before the process can be unconditionally recommended, even just for control of the odors in the gutter and when spreading on land. Operational criteria must be developed if the method is to serve for complete treatment of livestock manure, with an effluent that can be accepted by public health and water board standards. Adaptations of the oxidation ditch for the treatment of livestock manure are surely forthcoming, in view of the intense research that is in progress in the United States and abroad. However, until the current problems are resolved, the disposal of livestock manure in a manner that does not have an odor nuisance and a water pollution hazard remains a complicated problem. (White-Iowa State)
W71-02042

DRYING POULTRY MANURE INSIDE THE POULTRY HOUSE,
Pennsylvania State Univ., University Park. Dept. of Poultry Science.
Glenn O. Bressler.
Agricultural Engineering, Vol 51, No 3, p 136, March 1970.

Descriptors: *Farm wastes, *Poultry, *Drying, Ventillation, Waste storage.
Identifiers: *Poultry manure.

In this drying system droppings are removed at a very low moisture level, cutting weight of material to be handled by two-thirds. Eight 3000-cfm circulating fans are mounted about 22 ft. apart directly below 2 lines of water troughs that run the full length of the house. Fans are about 10 in. above the manure; air velocities over the droppings are about 250 to 750 fpm. A spike-tooth harrow is pulled daily through the accumulating droppings to stir them and to draw partially dried droppings into the high-velocity airstream. From the pit the droppings go either to truck or manure spreader or to a hammermill to be finely ground and bagged. The amount of water removed daily to prevent excess humidity and to dry the manure ranged from 6-9 gallons per hour. These results are from a flock of 3246 pullets and cockerels at 22 weeks in a 30-ft. by 100-ft. environment-controlled laying house. (White-Iowa State)
W71-02043

SWINE MANURE -- LIABILITY OR ASSET,
Purdue Univ., Lafayette, Ind.
David H. Bache.
Paper presented at the American Pork Conference, Des Moines, Iowa, March 3, 4, and 5, 1970. 13 p, 10 ref.

Descriptors: *Farm wastes, *Economics, *Costs, Water pollution, Air pollution, Confinement pens, Storage capacity, Fertilizers, Swine, Cattle, Poultry, Lagoons, Odor, Oxidation, Legislation.
Identifiers: *Assets, *Liability, Slatted floors, Land disposal, Innovators penalty, Pollution abatement grants.

Swine manure is a very modest asset on crop farms and it can be a major liability on those production units with no crop land base. A literature and research review gives costs and economic value of different manure treatment systems through the past ten or fifteen years. Conclusions reached include: there is no waste disposal problem with a pasture system, there is no economically feasible alternative to the spreading of solid manures, smaller swine production units will probably find that lagoon disposal is the optimum technique for handling hog wastes, and larger production units will be shifting to the use of slatted-floors, under floor manure forage, and liquid disposal systems. Public concern and legislation is discussed. (White-Iowa State)
W71-02047

PROCEEDINGS OF ANIMAL WASTE MANAGEMENT CONFERENCE.
Federal Water Pollution Control Administration, Kansas City, Mo.

Kansas City, Department of the Interior, February 1969. 40 p.

Descriptors: *Farm wastes, *Cattle, *Water pollution control.
Identifiers: *Feedlot pollution control, *State status reports, Animal production, Model feedlot regulation, Animal waste management.

An objective of the conference was to review the problem, as it exists today, of animal waste management. Information was given on how to conduct a state inventory of feedlots. A report was given on the Kansas animal waste control program. Control devices for animal feedlot runoff were discussed. The results of some feedlot pollution control research in Colorado and Nebraska was given. Status reports of 9 state pollution control programs were given, as well as model feedlot regulation design. (White-Iowa State)
W71-02049

WATER SUPPLY AND POLLUTION CONTROL PLANS FOR VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.

Available from NTIS as PB-190 810, $3.00 in paper copy, $0.95 in microfiche. Volusia Council of Governments Report, March 1970. 275 p, 26 tab, 17 ref.
Identifiers: *Water supplies, *Florida, *Sanitary engineering, Urban planning, *Water pollution, Control, Sewage, Population, Costs, Water resources, *Volusia County (Fla), Regional planning and development.

The report presents the findings of a long-range planning study to determine water and sewerage facilities requirements for Volusia County at the year 2000.
W71-02050

INVESTIGATION OF PERFORMANCE CHARACTERISTICS FOR SANITARY PLUMBING FIXTURES.
National Bureau of Standards, Washington, D.C. Building Research Div.

Available from NTIS as PB-189 456, $0.70 in paper copy, $0.95 in microfiche. NBS Building Science Series B5522, Jan 1970. 68 p, 30 tab, 25 fig, 38 ref.
Identifiers: *Sanitary engineering, Test methods, Reinforced plastics, Wear resistance, Glass textiles, Shock resistance, Thermal shock, Defects (Materials), Specifications, Impact shock, Performance (Engineering), Standards, *Plumbing fixtures.

The report gives findings and recommendations developed during an investigation of performance characteristics for sanitary plumbing fixtures. The report describes the test methods that are recommended for the evaluation of 16 performance characteristics, and the nature of further work required to complete the development of four or five additional test procedures. The suitability of various existing test methods for evaluating the functional and performance characteristics of sanitary plumbing fixtures was investigated in the laboratory. In addition, new or modified tests for certain characteristics were developed. The laboratory work was performed only on bathtubs and flat specimens provided by industry. Field inspection trips were made to provide the NBS project staff with up-to-date information on certain manufacturing processes and on installation and use problems. The complexities involved in the selection of valid performance levels are discussed, as well as the elements of judgment involved. A format that might be used in specifying performance is suggested for each test procedure and the rationale underlying each suggested format is given.
W71-02052

SPECIAL REPORT: COOLING TOWERS.

Industrial Water Engineering, Vol 7, No 5, p 22-53, May 1970.

Descriptors: *Cooling towers, *Thermal pollution, *Cooling water, Industrial water, Heat transfer, Evaporation, Heat balance, Vapor pressure, Thermal power plant, Environmental effects.
Identifiers: Impact of cooling towers.

A special report consisting of several contributions is presented. This report is divided into five sections: (1) tower section; (2) water-consumption; (3) chemical treatment; (4) automatic controls; and (5) field evaluation of the tower. The use of evaporative cooling towers rather than once-through systems could increase the cost of generating power by as much as 5%. Cooling tower selection is dependent on (1) amount of cooling water, (2) entering water temperature, (3) leaving water temperature, (4) temperature of the air entering the tower. The possibility of water reuse is discussed. The cooling operation can be automated and automatic control systems are described. Four types of pollution exist, thermal, steam, air, and land which have to be taken into account when towers are considered. (Novotny-Vanderbilt)
W71-02064

COOLING TOWER DESIGN CRITERIA AND WATER TREATMENT,
Black and Veatch, Kansas City, Mo.
F. W. Motley, and T. C. Hoppe.
Cooling Tower Institute Meeting, Aspen Colorado, June 22-25, 1970. 15 p.

Descriptors: *Cooling Towers, *Design criteria, Cooling, *Thermal Pollution, Heat budget, Evaporation, Environmental effects, Thermal power plants, Nuclear power plants, Heat water purification, Waste water disposal, Corrosion control, Biological properties.
Identifiers: Cooling Tower design.

Major considerations involved in selecting the cooling water system of a large industrial plant are presented in this paper. Cooling tower specifications and testing are reviewed. The paper also presents considerations for the water treatment and waste water disposal of a cooling water system utilizing a tower. Approximately 50% of the heat input to a modern fossil fueled unit is rejected to the cooling water. A nuclear fueled unit rejects about 50% more heat than a fossil fired unit per kw hour. A basic cooling system which is described further has been applied. Some practical experiences with cooling system operating are discussed from the standpoint of process control, process leaks, corrosion, chemical conditioning, blowdown, biological and microbiological problems, etc. (Novotny-Vanderbilt)
W71-02073

CONTROL OF COOLING TOWER MIST,
Celanese Chemical Co., Clarkwood, Tex.
R. H. Maurer.
Cooling Tower Institute, Semi annual Meeting, Snow-at-Aspen, Colorado, June 22-24, 1970. 7 p, 3 fig.

Descriptors: *Cooling towers, Fog, *Thermal pollution, Temperature, Safety, Mist heated water.
Identifiers: Visibility hazard, Exhaust air, Gas burners.

Means of solving a visibility hazard due to mist from cooling towers are described: Possible methods of controlling cooling tower mist emission are (1) installations of electrostatic precipitators on the cooling tower exhaust air, (2) elimination of fog particles by impingement upon wiremesh, (3) by seeding, (4) chemical spraying, (5) by the nylon string fog dispersion method, (6) heating the cooling tower exhaust air with steam heating coils and (7) with natural gas burner. It was found that exhaust re-heat method was the best solution to the problem. Safety from fires is a major concern. The total cooling water circulation rate is 116,000 gpm with 17.9F average temperature difference across the cooling towers which have the mist control facilities. The anticipated maximum natural gas requirement is 16.5 mm SCFD under average fogging condition. (Upadhyaya-Vanderbilt)
W71-02074

ENVIRONMENTAL CONTROL - WATER: MANY GAINS, MUCH TO BE DONE,
For primary bibliographic entry see Field 05G.
W71-02101

DEVELOPMENTS IN WATER QUALITY RESEARCH, PROCEEDINGS OF THE JERUSALEM INTERNATIONAL CONFERENCE ON WATER QUALITY AND POLLUTION RESEARCH, JUNE 1969.
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 05G.
W71-02102

IRRIGATION WITH RECLAIMED WASTEWATER,
Hirsch and Koptionak, San Diego, Calif.
Lawrence Hirsch.
In: Shuval, H. I., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Michigan, 1970, p 251-258. 5 ref, 1 tab, 1 fig.

Descriptors: *Water reuse, Rates, Irrigation efficiency, Nutrient requirements.
Identifiers: *San Diego County, Hershkovitz, Feinmesser, Los Angeles Chamber of Commerce.

Since the projected cost of potable water per acre foot in San Diego County, California is expected to double within ten years, the author stresses the need for 'intensified future utilization of reclaimed waste water.' Although he mentions some of the detrimental chemical and public health factors. he concludes that reclaimed water contains a higher level of plant nutrient value and if 'well-oxidized, non-putrescible and reliably disinfected or filtered' is not harmful to health. In addition, the nitrogen, phosphorus and potassium found in reclaimed water is marketable as fertilizer. (See also W71-02102) (Holmes-Rutgers)
W71-02103

THE OUTLOOK FOR WASTE WATER UTILIZATION IN ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Sanitary Engineering Labs.
Alberto M. Wachs.
In: Shuval, K. T., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1970, p 109-123. 12 ref, 5 fig, 2 tab.

Descriptors: *Water reuse, Cost-benefit analysis, Salinity, Nutrient requirements, Oxidation lagoons.
Identifiers: *Dan Region Project for Waste water Reuse, Parkhurst, Stephan, Weinberger.

In Israel, where 85 percent of available natural water resources are already being utilized 'it becomes necessary to use water from natural resources more than once.' The author discusses the construction and costs of the largest waste water reuse project in Israel, namely the Dan Region Project which includes TelAviv and six surrounding municipalities. Since the alternative to waste water reuse is seawater desalination, the author concludes that the former compares favorably with the latter in terms of costs. Although waste water reuse in agriculture is still a costly undertaking, the author believes that the costs of disinfecting sewage may be able to be met by the savings in chemical fertilizers thereby incurred. (See also W71-02102) (Holmes-Rutgers)
W71-02104

COMBINED SEWER CONSIDERATIONS BY PHILADELPHIA,
Philadelphia Water Dept., Pa. Water Pollution Control Div.
Carmen F. Guarino, Joseph V. Radziul, and William L. Greene.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA1, p 1-14, February 1970. 3 fig, 20 ref.

Descriptors: *Sewers, *Pollution abatement, *Methodology, Legislation, Water quality.
Identifiers: *Combined sewers, *Philadelphia, Storm sewers, Sanitary sewers.

City of Philadelphia's experience and study of the combined sewer over-flow pollution problem are described. Water quality legislation and pollution abatement philosophy are considered. The needs for problem definition are delineated along with pertinent constraints of existing methodology and measuring instrumentation. Costs and economic analysis of some abatement schemes are evaluated. Complete separation of stormwater and sanitary wastes, storage in conduit or detention basins, a total systems concept and the microstraining, chlorination, and ozonation of discharges are some of the principles reported for the control and treatment of combined sewer over-flows, or both. Emphasis is directed to the determination of priorities in resolving the overall national pollution problem and the need for a systematic approach. (Davis-Chicago)
W71-02120

5E. Ultimate Disposal of Wastes

DIFFUSION OF HORIZONTAL BUOYANT JET DISCHARGED AT WATER SURFACE,
Tokyo Univ. (Japan).
For primary bibliographic entry see Field 05B.
W71-01790

SEPTIC TANK SYSTEMS,
Brown and Caldwell, San Francisco, Calif.
For primary bibliographic entry see Field 05D.
W71-01842

MARINE EFFLUENTS RESEARCH AND MARINE DISPOSAL OF EFFLUENTS,
For primary bibliographic entry see Field 05D.
W71-01983

MANAGEMENT OF FARM ANIMAL WASTES.
American Society of Agricultural Engineers, St. Joseph, Mich.
For primary bibliographic entry see Field 05D.
W71-01992

PUMPING MANURE SLURRIES,
California Univ., Davis. Dept. of Agricultural Engineering.
S. A. Hart, J. A. Moore, and W. F. Hale.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 34-38. 22 fig, 2 tab, 5 ref. Public Health Research Grant EF-265.

Descriptors: *Pump testing, *Slurries, *Farm wastes, *Waste disposal, *Performance, Waste dilution, Efficiencies, Contrifugal pumps.
Identifiers: Handling, Capacity, Positive displacement, Diaphragm, Input horsepower, Selection criteria.

The purpose of this report was to analyze the performance characteristics of the different kinds of pumps under various conditions. Five pumps, representing centrifugal, positive displacement, and diaphragm types were tested. A pump was always tested with water first. Fresh manure was then mixed with the water to form a slurry. This was kept well mixed both by recirculation by the pump and by continuous mixing of the storage tank. Some 300 individual runs were made in testing the five pumps with three manures at various speeds. Dilution was more important than kind of pump, thin slurries being most satisfactory. Practical and economic conditions are discussed relating to pump selection. (See also W71-01992). (Christenbury-Iowa State)
W71-02000

ENGINEERING PROBLEMS IN YEAR-ROUND DISTRIBUTION OF WASTE WATER,
Pennsylvania State Univ., University Park, Pa. Dept. of Agricultural Engineering.
E. A. Myers.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 38-41. 1 tab, 2 fig, 6 ref.

Descriptors: *Sprinkling, *Distribution systems, *Sewage disposal, Farm wastes, Freezing, Winter, Distribution patterns.
Identifiers: Deflector stationary sprinklers, Year-round irrigation.

This paper presents some of the problems encountered which may be considered in the design, installation, and operation of irrigation systems for animal-waste disposal. The system used to distribute waste water at Penn State is first explained briefly. Then the problems encountered are discussed under the headings: pumping, pipe system, and irrigation heads. (See also W71-02001). (Christenbury-Iowa State)
W71-02001

SLOPING FLOORS FOR BEEF-CATTLE FEEDLOTS,
California Univ., Davis.
For primary bibliographic entry see Field 05D.
W71-02002

CATTLE-MANURE HANDLING AND DISPOSAL SYSTEMS ON THE WEST COAST,
Washington State Univ., Pullman. Dept. of Agricultural Engineering.
E. H. Davis.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 45-47. 3 ref.

Descriptors: Cattle, *Farm wastes, *Farm management, Project planning, Environmental sanitation.
Identifiers: Loafing sheds, Liquid manure, *Health authorities, Alleyways, Holding tanks.

Stall housing, an acceptable practice, produces manure which requires special handling. The method of handling and disposing of manure in a sanitary manner depends on climatic conditions and management practices. Disposal of animal wastes is part of the livestock enterprise and should be charged to this operation. As animals and people get closer together in heavily populated areas, disposal of animal wastes in a sanitary manner becomes increasingly important. Close working relationships with state health departments is essential. Additional research is needed concerning lagoon, nitrate contamination of underground

water supplies, grinding units for processing beef and dairy manures, and agitation equipment for large holding tanks. (See also W71-01992). (Christenbury-Iowa State)
W71-02004

ECONOMIC EVALUATION OF LIQUID-MANURE DISPOSAL FOR CONFINEMENT FINISHING OF HOGS,
Illinois Univ., Urbana. Dept. of Agricultural Economics.
Richard P. Kesler.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No SP-0366, Michigan State University, May 1966, p 122-125. 6 tab, 2 ref.

Descriptors: *Farm wastes, *Swine, *Disposal, *Economics, *Annual cost, Lagoons, Storage capacity, Size, Nutrients, Ultimate disposal, Liquid wastes.
Identifiers: Manure, Total lagooning, Hauling and spreading, Recovery rate, Fertilizer nutrients, Salvaged nutrients.

Manure is a valuable by-product of the hog industry. This manure must be disposed of on the land to obtain its inherent value. Factors that should be considered in choosing a manure disposal system are (a) amount of manure that is produced, (b) fertility content of the manure and its value as a replacement for commercial fertilizer, (c) disposal costs of each system, and (d) availability of cropland on which to spread the manure. An extensive economic analysis of three disposal systems is presented: (I) Total hauling and spreading, (II) Total lagooning, and (III) Partial hauling and spreading and lagooning. Three sizes of hog operation were considered in the comparison: 500, 1500, and 2500 head. (See also W71-01992) (Christenbury-Iowa State)
W71-02028

FARM WASTE DISPOSAL-AMENITY AND GOOD NEIGHBOURLINESS,
K. B. C. Jones.
Great Britain Ministry of Agriculture, Vol 77, No 4, p 165-167, April 1970.

Descriptors: *Farm wastes, *Odor, *Water pollution, *Building codes.
Identifiers: *Noise, *Nuisances, *Legal action, Solid refuse.

A general picture of waste pollution in England's country-side is shown by comparing today's production and disposal with that of yester-year's. Nuisances that are annoying to both farmers and city-dwellers are described. The rights and liabilities of both farmer and city-dwellers are outlined. (Miner-Iowa State)
W71-02048

5F. Water Treatment and Quality Alteration

PLAQUING AND IMMUNOLOGICAL METHODS FOR DETECTION AND IDENTIFICATION OF ENTEROVIRUSES,
Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.
For primary bibliographic entry see Field 05A.
W71-01651

A MASTER PLAN REPORT FOR THE ATLANTIC COUNTY NEW JERSEY PLANNING BOARD, WATER AND SEWER STUDIES.
Atlantic County Planning Board, Atlantic City, N.J.
For primary bibliographic entry see Field 05D.
W71-01875

HEALTH ASPECTS AND VECTOR CONTROL ASSOCIATED WITH ANIMAL WASTES,
Public Health Service.
W. M. Decker, and J. H. Steele.
Proceedings National Symposium on Animal Waste Management, ASAE Publication No. SP-0366, Michigan State University, May 1966, p 18-20. 12 ref.

Descriptors: *Farm waste, *Zoonoses, *Salmonella, *Mycobacterium, *Diseases, Water pollution sources, Public health.
Identifiers: *Pathogenic organisms, Brucella, Leptospira.

The diseases contracted by man from animals are discussed. Q fever, Anthrax, Salmonellosis, Tuberculosis, Brucellosis, and Leptospirosis are the major diseases examined. The source of the disease and the means by which man contracts the diseases are presented. Other pathogenic organisms arising from animals are mentioned. (See also W71-01992). (Christenbury-Iowa State)
W71-01995

WATER SUPPLY AND POLLUTION CONTROL PLANS FOR VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.
For primary bibliographic entry see Field 05D.
W71-02050

SOFT WATER SUPPLY FOR URBAN CONSUMPTION, A FEASIBILITY STUDY,
Tahal - Water Planning for Israel Ltd., Tel Aviv.
P. Dalinsky.
In: Shuval, K. T., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1970, p 79-87. 23 ref, 4 tab, 1 fig.

Descriptors: *Municipal water, Water softening, Expenditures, Economic feasibility, Cost benefit analysis.
Identifiers: *Dan Regional Scheme, American Institute of Laundering, World Health Organization, Holland.

Hard water in Israel causes increased consumer expenditures of soaps and clothes. A comparative economic analysis of three alternative methods of supplying soft water to the 7-city Dan (Tel Aviv) Regional Scheme is presented in this paper. Factors such as savings in soap consumption, reduction in clothes wear-and-tear, savings in salt costs, savings in sewage project investments are included in the feasibility study. The report emphasizes the economic benefits to be derived from the supply of soft water to urban areas. (See also W71-02102) (Holmes-Rutgers)
W71-02106

5G. Water Quality Control

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 06A.
W71-01658

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
Glenn W. Graves, Andrew B. Whinston, and Gordon B. Hatfield.
Paper copy available from SOD order as: I67.13/4: 16110FPX08/70 Price $1.25 MF. available from NTIS as PB-195 830, Price $0.95. Water Pollution Control Research Series, 16110 FPX 08/70, August, 1970. 123 p, 27 tab, 18 fig, 13 ref, 2 append. FWQA Project 16110 FPX.

Descriptors: *Regional analysis, *Waste water treatment, *River basin development, *Optimum development plans, Estuaries, Simulation, Water quality, Mathematical models, Computer programs, Optimization.
!dentifiers: Nonlinear programming, Cost minimization, *Delaware estuary, Algorithms.

An application of a non-linear programming algorithm to the problem of optimal water quality control in an estuary is described. The mathematical model that was developed gives the solution to the general mixed case of at-source treatment, regional treatment plants, and by-pass piping. The non-linear algorithm is developed in considerable detail and a sample problem is worked out. Detailed results are presented for a pilot problem to illustrate the method of solution. Actual data from the Delaware Estuary is used to solve a large scale problem and the solution is given. The results indicate that a regional treatment system for the Delaware Estuary is superior, in terms, of total cost, to other proposed schemes. (Graves-UCLA)
W71-01659

AREAWIDE SEWERAGE MASTER PLAN REPORT FOR THE DENVER METROPOLITAN AREA. PHASE I (INVENTORY).
Denver Regional Council of Governments, Colo.
For primary bibliographic entry see Field 05D.
W71-01687

COMMENTARY IN SOVIET PERIODICALS ON ENVIRONMENTAL POLLUTION,
Joint Publications Research Service, Washington, D.C.
V. S. Vishnyakov.
Translations of: Priroda, No 4: p 93-97, 1966. Available from NTIS as PB-190 788T, $3.00 in paper copy, $0.95 in microfiche. Joint Publications Research Service Trans 36,815, August 3, 1966, various pagings.
Identifiers: *Air pollution, *USSR, *Water pollution, USSR, Wastes (Industrial), Control, Rivers, Aquatic animals, Industries, Purification, Environment, Contamination, *Air pollution control equipment.

One major contributing factor to the Soviet pollution problem is the divergency between parochial economic benefits and wider public interest. The nature of the Soviet system adds to these difficulties. First, those responsible for making economic decisions with consequences for the pollution situation are subject to incentives and penalties designed to make them maximize production. Second, and more important, the regime's priority attachment to the goal of economic growth diminishes the possibility of its acting as an honest arbiter between narrow economic and overall public interests. It would appear from the writings that the USSR has its share of individuals dedicated to the cause of conservation and that, moreover, these people have a chance to be heard. But aside from passing an occasional anti-pollution decree or fining a blatant malefactor now and then, the regime's growth-at-all-costs orientation is never far from the surface. A collection of Soviet articles on environmental pollution problems in USSR are presented.
W71-01688

VOLUNTARY PRIVATE BEHAVIOR AS A MEANS TO REDUCE CONSUMER HEALTH HAZARDS AND ENVIRONMENTAL POLLUTION,
Brookings Institution, Washington, D.C.
Carl W. Bruch.
Available from NTIS as PB-189 389, $3.00 in paper copy, $0.95 in microfiche. Study Report, 1969. 203 p, 172 ref.
Identifiers: *Public health, Hazards, *Management planning, Environment, Air pollution, Water pollution, Wastes (Industrial), Industrial relations, Attitudes, Organizations, Control systems, Voluntary waste control, Pollution control.

The document is concerned with how much reliance the public should place on voluntary private behavior to protect the environment and the consumer and whether the voluntary activities of industry possessed the potential to obtain necessary changes in environmental quality and protection from consumer health hazards. This study examined the nature of the regulatory process as a legal and administrative tool, the role of incentives and economics in pollution control, and a qualitative estimation of achievements of voluntary private behavior in the reduction of direct health hazards associated with foods, drugs, and cosmetics, and the indirect health hazards from air, water and solid waste pollution.
W71-01880

AN ECONOMIC STUDY OF THE EFFECT OF MUNICIPAL SEWER SURCHARGES ON INDUSTRIAL WASTES,
North Carolina Water Resources Research Inst., Raleigh.
Don E. Ethridge.
Available from NTIS as PB-195 981, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute, Report No 41, November 1970. 122 p, 8 tab, 12 fig, 34 ref, 3 append. OWRR A-047-NC (2).

Descriptors: Evaluation, *Costs, Sewers, *Industrial wastes, Poultry, Industrial use (Water), Biochemical oxygen demand, Municipal wastes, Municipal water.
Identifiers: *Sewer surcharges, *Surcharges, *Poultry processing industry, *Beet processing industry.

This study analyzes the industrial response to sewer surcharges (1) in a theoretical framework and (2) using two empirical estimation procedures. The purpose is to develop and appraise alternative methods of studying the response of specific industries. A synthetic or budgeting approach was used to estimate firm's responses for the beet processing and poultry processing industries. It was estimated that a typical beet processing plant would reduce its wasteload discharged by 75 percent if faced with a surcharge of 2 cents per pound of BOD (from 31,600 pounds of BOD (Biochemical Oxygen Demand) per day with no surcharge to 7,770 pounds of BOD per day with a surcharge of 2 cents per pound of BOD). The corresponding estimate for a poultry processing plant was a reduction of 32 percent. It was estimated that the elasticity of total pounds of BOD discharged by beet processing plants with respect to the surcharge on BOD is -.7 at a 'typical' surcharge of approximately 2 cents per pound of BOD. The corresponding elasticity estimate for poultry processing plants was estimated to be -.15. Regression analysis was also used to estimate firms' responses for the poultry processing industry. The resulting estimate of the elasticity of total pounds of BOD discharged with respect to the surcharge was -.23.
W71-01897

WATER QUALITY CONTROL WITH SYNTHETIC POLYMERIC FLOCCULANTS,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 05D.
W71-01899

SEPARATION OF OIL AND WATER WITH GRAVITY SEPARATOR (FRENCH),
Laval Univ., Quebec; and Hydraulic Research Inst., Bratislava (Czechoslovakia).
K. Rohan, and M. Zajdlik.
English synopsis. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 177-189, 1969. 13 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Water pollution, *Groundwater, *Oil wastes, *Separation techniques, Infiltration, Model studies, Mathematics, Equations, Path of pollutants, Foreign projects.
Identifiers: *Hydraulics Laboratory of Bratislava (Czechoslovakia).

This paper gives the test results and computation methods used in the Hydraulics Laboratory of Bratislava, Czechoslovakia, concerning oil and water mixtures with emphasis on protection of groundwater supplies against pollution from oil pentration. Related equations and graphs are included. It is possible to utilize gravity separators because water and oil usually do not create emulsions. (Woodard-USGS)
W71-01930

REMOVAL OF SALINE WATER FROM AQUIFERS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
E. J. Carlson, and P. F. Enger.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 121-134, 1969. 14 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Saline water-fresh-water interfaces, *Leaching, *Saline water systems, *Groundwater movement, Drainage systems, Hydraulic models, Mathematical models, Aquifers, Model studies, Drainage programs, Subsurface drainage, Water management (applied).
Identifiers: Aquifer sweetening, Aquifer desalination.

Aquifer desalting was studied in a rectangular, glass-walled, sand-filled tank and in a mathematical model. Two types of aquifers were studied: (1) a 1:40 scale, two-part aquifer (course and fine sand) representing a vertical cross section through an idealized portion of an irrigated valley; and (2) a fine sand, single-part aquifer used to evaluate a formula derived from the Ghyben-Herzberg principle for computing depth to a saline-fresh water interface. Salt water was flushed from the aquifers into subsurface drains by applying fresh water to the surface. Test results for both aquifer types showed that tile drains placed near the ground surface will not intercept and discharge surface-applied fresh water if all or part of the aquifer contains salt water. The fresh water displaces the salt water without appreciable mixing and moves it into the drains. A stable fresh-salt water interface is thereby formed in the aquifer. Reduced spacing of drains reduced the amount of salt water that will be removed from the aquifer. Progress of the tests was recorded in still and timed-sequence motion pictures. (Knapp-USGS)
W71-01932

INVESTIGATION OF AXISYMMETRICAL STRATIFIED FLOW TOWARDS A POINT SINK,
Tokyo Inst. of Tech. (Japan); and Japan Atomic Power Co., Tokyo. Civil Engineering Section.
Mikio Hino, and Sotoaki Onishi.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 289-296, 1969. 8 p, 3 ref.

Descriptors: *Water resources, *Stratified flow, *Intakes, *Flow characteristics, Water storage, Withdrawal, Model studies, Theoretical analysis, Water quality, Salinity, Mathematics, Equations, Foreign projects.
Identifiers: Japan.

The flow towards an intake riser pipe is theoretically analyzed as an axisymmetrical flow into a point sink. Experiments were carried out in a lucite tank with a bottom shaped in a 1/4 circle, 60 cm deep. At the center of circle, the tank had a cylindrical outlet with a diameter of 6 cm and 25 cm high into which an intake cylinder with a slot was inserted. Several kinds of intake cylinders, each of which has a different location of the slot, were prepared. Various densities of salt water layers were used, and graphs and diagrams relate flow systems and selective withdrawal. (Woodard-USGS)
W71-01960

EFFLUENT FROM A SLOT INTO STAGNANT OR MOVING AMBIENT FLUID OF GREATER DENSITY,
Hydraulics Research Station, Wallingford (England).
Habib O. Anwar.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 297-308, 1969. 12 p, 8 fig, 4 ref.

Descriptors: *Density stratification, *Effluents, *Fresh water, *Heavy water, *Model studies, Mathematics, Equations, Stagnant water, Movement, Density, Profiles, Salinity, Vertical migration, Laboratory tests, Foreign projects, Hydraulic properties.
Identifiers: *Ambient fluid, Hydraulics Research Station (Wallingford, England).

Investigations were conducted at the Hydraulics Research Station, Wallingford, England, to determine the effects of vertically discharging fresh water upward into an ambient fluid of greater density. The ambient fluid was a solution of salt water with uniform density, and was either stationary or moving slowly upward. Density profiles were determined by measuring the concentration of the salt solution using an electrical conductivity probe, and were found to be of Gaussian form close to those of a natural convection plume. The nozzle densimetric Froude number, based on the slot width, ranged from 4 to 10. The results of this investigation are related to an effluent discharged from a long diffuser pipe into sea water. The flow at a small distance from the diffuser can be regarded as a flow from a line source with a finite width. Related graphs and equations are included. (Woodard-USGS)
W71-01961

MANAGEMENT OF FARM ANIMAL WASTES.
American Society of Agricultural Engineers, St. Joseph, Mich.
For primary bibliographic entry see Field 05D.
W71-01992

HEAT REJECTION REQUIREMENTS OF THE U. S.,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-02062

CHANGING EMPHASIS IN THE SITING OF STEAM ELECTRIC POWER STATIONS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05C.
W71-02063

COMPARISON OF DIFFERENT TYPE COOLING TOWERS FOR GAS TURBINE INLET AIR SERVICE,
West Texas Utilities Co., Abilene.
A. R. Cox.
Cooling Tower Institute, June 22, 1970. 8 p, 3 fig.

Descriptors: Cooling towers, Freezing, Alkalinity, Temperature, Dual system.
Identifiers: Spray-type tower, Gas turbine generators, Compressors, Forced-draft, Wood structure, Topping cycle.

West Texas utilities company has three gas turbine generators and all three units are served by cooling towers to cool and clean the inlet air to the gas turbine compressors, in order to maintain maximum efficiency and capabilities of the units. A combined

cycle arrangement of a 25 mw gas turbine generator with a 100 mw steam turbine generator at San Angelo has proven to be a very efficient arrangement. Operation during cold weather presents a freezing problem in the cooling tower and eliminators. This could result in blockage of the air passages which might damage the cooling tower, the air ducts, or the compressors. An automatic shut down of the circulating water pumps is provided to function at 40F to eliminate the freeze-up hazard. The Rio Pecos gas turbine generator is a 5 mw unit and the inlet air cooling tower is a wood structure, installed in 1954 at a cost of 7,300dollars. Acid is used for alkalinity reduction to hold the basin water pH between 7.0 and 7.5. A brief description and the figures of three cooling towers are shown. (Upadhyaya-Vanderbilt)
W71-02069

THERMAL POLLUTION CONTROL IN BAVARIA,
Bavarian Bureau of Water Supply and Pollution Control, Munich (West Germany).
F. K. Von Ammon.
Proceedings of the 24th Industrial Waste Conference May 6, 7, 8, 1969 Purdue University, p 1357-1360.

Descriptors: *Thermal pollution, Evaporation, Temperature, Self-purification, Cooling water, Reservoirs, Dissolved oxygen, Aeration Analysis.
Identifiers: Water organisms.

The harmful influence of a heat discharge is exerted in three principal ways. These are, evaporation of water, creating a decrease of flow and dilution of other wastes, direct influence of high temperatures on water organisms and reduction of self-purification capacity. For water resources management, there is a need for a simple method of estimating heat load in a certain reach of a river. The next step is to select a permissible maximum temperature in the river. In Bavaria 28C is often used. For the Danube river, which still contains valuable fish and has a lower natural temperature, 25C has been set. Experience has shown that the cooling time often lies in the region of 2-3 days under summer conditions. This means, in an impounded river, that there is the possibility of a power station approximately every 20 km. In several cases, where the receiving water is polluted, the cooling water has to be aerated. (Upadhyaya-Vanderbilt)
W71-02071

CONTROL OF COOLING TOWER MIST,
Celanese Chemical Co., Clarkwood, Tex.
For primary bibliographic entry see Field 05D.
W71-02074

A STEADY STATE OPTIMAL DESIGN OF ARTIFICIAL INDUCED AERATION IN POLLUTED STREAMS BY THE USE OF PONTRYAGIN'S MINIMUM PRINCIPLE,
Rutgers - The State Univ., New Brunswick, N.J.; and Electronic Associates, Inc., Princeton, N.J.
Burton Davidson, and Robert W. Bradshaw.
Water Resources Research, Vol 6, No 2, p 383-397, April 1970. 15 p, 13 fig, 1 tab, 17 ref.

Descriptors: *Optimization, *Pollution abatement, *Steady flow, *Digital computers, *Analog computers, Rivers, Aeration, Systems analysis, Constraints, Dissolved oxygen, Biochemical oxygen demand, Laplaces equation.
Identifiers: Algorithm, Pontryagin's minimum principle, Streeter-Phelps equation.

Optimum control theory based on Pontryagin's minimum principle was applied to the problem of specifying the steady state distribution of artificial aeration in polluted rivers. The optimization was developed for a general integral type cost functional with weighted energy contraints. It was composed of four main parts: (1) the objective function, (2) the performance equations, (3) the optimizing algorithm, and (4) the methods of solution. The system equations used were of the classical Streeter-Phelps genre with an induced aeration term added as the control function. A small highly polluted river in a state of steady flow with a typical Streeter-Phelps dissolved oxygen (DO) sag profile, a first-stage biochemical oxygen demand (BOD) profile, and isothermal conditions was considered. The formulation of the problem yielded the famous Riccati-Kalman structure and an analytical solution. Several optimal and suboptimal aeration designs at different temperature levels were obtained using a digital computer and an automatic plotting routine. An analog computer was used in the critical stages of the numerical solutions. Results from the analog computer pointed the way to the ultimate use of Laplace transform techniques in conjunction with a digital computer for maximum accuracy. The basic understanding of how optimal control theory can be used as a systems tool in the analysis of water quality control problems was furthered. (Kriss-Cornell)
W71-02095

ENVIRONMENTAL CONTROL - WATER: MANY GAINS, MUCH TO BE DONE,
Irvin Schwartz.
Chemical Week, Vol 106, No 24, June 17, 1970, p 90-97. 5 fig, 2 tab.

Descriptors: *Pollution abatement, Waste water treatment, Activated carbon, Thermal pollution, Dissolved oxygen, Biological treatment, Industrial water, Optimum development plans, Institutional constraints, Chemical wastes.
Identifiers: *Federal Water Quality Administration, United States Geologic Survey, Z-M process, Polyelectrolytes.

Chemical processing plants are being required to meet stricter water pollution control standards by the federal government. In order to meet the new standards, chemical companies are experimenting with less polluting methods for disposal, processing and using water. In the meantime, before these new methods are put into practice, several new ideas for biologically treating waste waters have been tried. The most discussed idea is activated carbon adsorption of organic pollutants. This article also lists new products which chemical companies have developed to assist treatment processing of industrial water wastes and urges joint industrial and municipal water waste treatment ventures. (Holmes-Rutgers)
W71-02101

DEVELOPMENTS IN WATER QUALITY RESEARCH, PROCEEDINGS OF THE JERUSALEM INTERNATIONAL CONFERENCE ON WATER QUALITY AND POLLUTION RESEARCH, JUNE 1969.
Hebrew Univ., Jerusalem (Israel).

H. I. Shuval, editor. Ann Arbor-Humphrey Science Publishers, Ann Arbor, Michigan, 1970.

Descriptors: *Water quality control, Waste water treatment, Return flow, Administration, Municipal water.
Identifiers: *Israel's National Water System, Jordan Project, Lake Kinneret, Dan Region Project.

This book is the published proceedings of the Jerusalem International Conference on Water Quality and Pollution Research, held at Hebrew University in June, 1969. The book includes twenty papers, divided into three general subject areas; water quality management, waste water treatment and utilization, and marine pollution. Half of the papers were written by Israeli Scientists and engineers, while the other half were written by South African and United States researchers in these fields. Appropriate portions of the publication are forwarded with abstracts of those portions. (See also W71-02103 thru W71-02106) (Holmes-Rutgers)
W71-02102

WATER QUALITY MANAGEMENT OF THE ISRAEL NATIONAL WATER SYSTEM,
Mekorot Water Company, Tel Aviv (Israel).
Yehuda Goldshmid.
In: Shuval, K. T., editor, Developments in Water Quality Research, Ann Arbor-Humphrey Science Publishers, Ann Arbor, Mich., 1970, p 3-17. 18 ref, 1 fig, 1 tab.

Descriptors: *Water management (Applied), Water quality control, Administration, Water resources development.
Identifiers: *Jordan Project, Lake Kinneret, Israel National Water System.

The construction, operation and management of the Jordan System, the largest single water supply project in Israel, is analyzed in detail in this paper. Although 80 percent of the water pumped through this system was intended for use in agriculture, it was constructed so that all the water could be treated and maintained at drinking-water standards. Therefore, Lake Kinneret, its watershed, the open canal and the reservoirs were viewed as one unit. The author points out however, that although the system has been in operation for five years, a watershed authority has not yet been created, thereby reducing the potential effectiveness. (See also W71-02102) (Holmes-Rutgers)
W71-02105

TOTAL DOLLAR BENEFIT OF WATER POLLUTION CONTROL,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
Nelson L. Nemerow, and Robert C. Faro.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA3, p 665-674, June 1970. 1 fig, 4 tab, 2 ref.

Descriptors: *Water pollution control, *Benefits, *Beneficial use, *Evaluation, Water quality, Costs, Analytic techniques, Cost-benefit analysis, Water utilization, Waste water disposal, Water supply, Land use, Recreation, Waste water treatment.
Identifiers: In-stream water uses, Willingness to pay.

Tangible dollar benefits of a lake or stream at a given water quality may be estimated by determining all uses which both affect and are affected by water quality, by independently valuing each use, and by summing the resultant values. Measurable beneficial water uses related to water quality include recreational uses, withdrawal water uses, wastewater disposal uses, bordering land uses and in-stream water uses. The value of each beneficial use may be estimated by a 'user willingness to pay' criteria or by an evaluation of benefits derived from avoiding payment. Application of this method to Onondaga Lake at Syracuse, New York, produces an estimated net social benefit of $4,400,000 per yr. Recreation proves to be the most important beneficial use for Onondaga Lake at improved water quality and recreational value comprises close to half of the total net annual benefits of decreased pollution. Estimation of tangible dollar benefits of water pollution control may be useful in the decision of the value of installing advanced forms of waste treatment by river basin firms composed of members representing all major groups in water-using society. (Davis-Chicago)
W71-02116

LAKE MICHIGAN DEVELOPMENT PROPOSAL.
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

Prepared by the Project in Planning and Design Class, Department of Civil Engineering, The Technological Institue, Northwestern University, Evanston, Illinois, May 1969. 81 p, 9 tab, 32 fig.

Descriptors: *Water quality, *Water supply, *Lake Michigan, *Dike, Earthworkers, Hydraulics, Airport, Water pollution, Bridge construction, Tunnel construction, Highways, Island, Canals, Locks, Costs, Waste dilution, Intakes, Turbidity.

Identifiers: *Lake airport, Artificial island, Sanitary canal, Metropolitan sanitary district, Dike Expressways.

This report presents a proposal for the management of the water quality of Lake Michigan by the construction of a barrier across its southern end. Such a barrier would isolate the largest concentrated area of waste discharges into the lake and prevent further deterioration of the quality of the water in the lake. It would protect the water supplies of the surrounding municipalities by maintaining a consistently high water quality, and would preserve the beaches and shore waters of much of the lake so that Lake Michigan can continue to be a major recreational resource. Three alternative plans are proposed, all of which create a barrier across the lake, but which differ in the extent of development. (See also W71-02157 and W71-02158). (Miller-Chicago)
W71-02156

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION, SAN JUAN COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01653

LAND CLASSIFICATION FOR IRRIGATION, CURRY COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01654

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
C. S. Beightler.
Available from NTIS as PB-195 829, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series 16110 FZE 09/70, Sept 1970. 13 p. FWQA Program 16110 FZE.

Descriptors: *River basin development, *Optimum development plans, *Dynamic programming reservoir design, Reservoir sites, Mathematical models, Optimization, Computer programs.
Identifiers: Algorithms.

Studies were made to determine the feasibility of applying recently developed analtyical techniques to the problem of planning for optimal water resource development. An optimal plan with regard to the size and location of proposed reservoirs was taken to be that physical configuration which provided the greatest net economic benefit to the people of the region while meeting future water needs. This research was aimed at providing an improvement over the sub-optimal planning techniques of the past which did not take into account the interacting effects which exist between each reservoir and all downstream reservoirs. These interacting effects are actually the predominant characteristics to be considered in the design of a system of reservoirs in any river basin, and cannot be ignored. For the purpose of formulating a mathematical model for this type of problem, a number of recently developed optimization techniques were studied. The best formulation was found to be that which treated the reservoir system design as a branched multistage decision process. In such processes, the decisions made at each stage (potential reservoir site) affect the circumstances under which all subsequent decisions in the system must be made. The intercoupled staging structure of this process was then exploited by means of the nonserial dynamic programming algorithms developed in the course of this research project. These algorithms are effectively decomposition techniques which break down the nonserial (i.e. branched) process into any equivalent serial process that is amendable to solution through ordinary dynamic programming methods. (Beightler-Texas)
W71-01658

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
For primary bibliographic entry see Field 05G.
W71-01659

ECONOMICS AND ECOSYSTEMS,
Jon Breslaw.
The Environmental Handbook, Ballantine Book Inc., New York, 1970. p 102-112.

Descriptors: *Environmental effects, *Social aspects, *Natural resources, *Third party effects, Balance of nature, Conservation, Cost-benefit analysis, Environmental ecology, Ecosystem.
Identifiers: *Externalities.

In the American economy the volume of residual waste products is almost as large as the volume of raw materials utilized. The cost system does not make adequate provisision for disposing of waste products, which often pollute the ecosystem and harm third parties. Such adverse effects are classes as externalities. Four corrective approaches are possible. The first is to 'internalize' externalities by enlarging the size of economic decision units. The second is to issue government regulations enforceable by law. The third is closely related to the second. It is to apply the law of nuisance. Methods two and three are our main reliance, but they have serious limitations. Method four involves the impositions of monetary sanctions to help preserve the environment. This can be done either by subsidizing desired courses of action, or by charging for socially harmful action. The latter method seems most advantageous. The policy regarding use of our scarce natural resources such as oil, would be greatly changed by application of the above principles. The costing of pollution effects plus reduced birth rates will be essential to preserving our environment. This article is marked by a good grasp of fundamentals and a very clear non-technical exposition. (Whipple-Rutgers)
W71-01750

A PRELIMINARY EVALUATION OF THE THERMAL EFFECTS OF THE BEN FRANKLIN DAM PROJECT ON COLUMBIA RIVER TEMPERATURES BELOW THE HANFORD PLANT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-02076

DIFCOR - A PROGRAM TO SOLVE NONLINEAR EQUATIONS,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, and Ralph F. Green.
Research Paper No 6, TVA, Div of Water Control Planning, Hydraulic Data Branch, Hydrol Res and Analysis Staff, June 1967. 31 p, 1 tab, 3 append, 3 ref.

Descriptors: *Optimization, *Statistical methods, *Mathematical models, *Computer programs, Regression analysis.
Identifiers: Nonlinear equations, Differential corrections, Principal component analysis.

A Fortran IV program called DIFCOR used to solve nonlinear equations by an optimization procedure termed, 'the method of differential corrections' was described. It was combined with the multivariate statistical technique of 'principal component analysis' used to minimize the sum of squares prediction error and provided a gregression procedure that could be used with virtually any model. With the present dimensions, up to 20 parameters and 300 observations may be analyzed. To use the program package two additional user subroutines were written for each particular problem. The subroutines gave the user considerable latitude in developing mathematical models. The paper documented the program and described what was computed in the user subroutines. (Kriss-Cornell)
W71-02080

OPTIMIZATION BY THE PATTERN SEARCH METHOD,
Tennessee Valley Authority, Knoxville.
Ralph F. Green.
Research Paper No 7, TVA, Div of Water Control Planning, Hydraulic Data Branch, Hydrologic Research and Analysis Staff, Jan 1970. 73 p, 8 fig, 4 tab, 7 ref.

Descriptors: *Optimization, *Mathematical models, *Least squares method, *Computer programs, Linear programming, Hydrologic properties, Rainfall, Flow.
Identifiers: *'Pattern search' method, Response surface, Nonlinear programming.

A method called 'pattern search' which has the ability to reach an optimum solution for a variety of models and data sets was described. It was divised to overcome the inadequacies of earlier methods of optimization and it does so by finding and following a topologic feature of the response surface. The response surface was described as the mapping of the objective function for the range of values of the parameters. A hypothetical response surface was illustrated. The different types of irregularities which adversely affect different optimization techniques for nonlinear models were explained and the 'iterative least squares' technique was discussed. Methods for coping with irregular response surfaces by accelerating the convergence by following a valley to the optimum were listed. Convergence on an acceptable solution is controlled by sensitivity and different types of sensitivity were mentioned. The program described in the report was written in Fortran IV for an IBM System/360 computer. A brief description of the major functions of the main program PATSEAR and its subroutines were given. Illustrations of the various uses of PATSEAR included (1) a linear model used to check the convergence properties of the 'pattern search' technique; (2) two arbitrary objective functions; and (3) two models of hydrologic systems, one a nonlinear function to predict loss from rainfall on a storm-by-storm basis and the other a daily flow prediction model. (Kriss-Cornell)
W71-02081

SYSTEM SIMULATION FOR ANALYSIS AND DESIGN,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Roy W. Hann, Jr.
Journal of American Water Works Association, Vol 62, No 5, p 279-284, May 1970. 7 p, 7 fig, 14 ref.

Descriptors: *Computer programs, *Hydraulic design, *Systems analysis, Civil engineering, *Programming languages, *Networks, *Simulation analysis, Reservoir operation, Steady flow, Pumps.
Identifiers: HYNET.

Presented in this paper was the basic philosophy and structure of problem oriented languages as they apply to Civil Engineering problem areas in general and the HYNET program in particular which was developed for hydraulic network analysis. The internal structure of HYNET was briefly discussed and the Problem Oriented Language (POL) package, which the author developed to be the heart of a number of problem oriented languages, was presented. The system was imple-

mented on both the IBM 1130 and IBM 360 computers and all system programming was in the Fortran IV computer language so that conversion to other computers was simple. The system described here was primarily the IBM 360 version. The specific capabilities of HYNET were described with regard to 'Usual' network analysis, to pump system balancing and to system simulation under dynamic conditions. The methodology described required the furnishing of reservoir geometry and initial reservoir conditions. An analysis was made via traditional network analysis and the resultant flows considered as steady state flows for some time period. The volumes in the reservoirs were then adjusted accordingly and the resulting new fixed heads between tanks and the new pump heads were calculated. The analysis cycle was then repeated for as many cycles as desired. The commands which were programmed into the present HYNET system were outlined and their use demonstrated in example problems. (Kriss-Cornell)
W71-02082

DESIGN OF A HYDROLOGIC CONDITION SURVEY USING FACTOR ANALYSIS.
For primary bibliographic entry see Field 04D.
W71-02085

OPTIMUM DESIGN OF COMPLEX WATER RESOURCE PROJECTS,
Rand Water Board, Johannesburg (South Africa).
David Stephenson.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 96, No HY6, p 1229-1246, June 1970. 18 p, 6 fig, 3 tab, 2 append. 5 ref.

Descriptors: *Optimization, *Linear programming, *Mathematical model, *River basins, Constraints, Hydroelectric plants, Reservoir storage, Water distribution (Applied), Draft-storage curves.
Identifiers: Vaal River, Tugel River, South Africa.

This paper concentrated on direct optimization of complex water resources projects, using linear programming and the principle of decomposition of linear programs. The water resources model was of the Vaal and Tugel River basins in South Africa and illustrated the optimum design of multi-interlinked river basins. Each river basin had a number of possible dam sites, some of which were suitable for generation of hydroelectricity. The supply of water to industrial and irrigation areas was considered and a pattern of development yielding maximum net benefit was compiled. Constraints on irrigable area, reservoir capacities urban water requirements and draft from reservoirs were expressed algebraically for formulating the mathematical model. The set of linear constraints on variables was tabulated together with benefit coefficients and linear programming methods used to optimized the system design. Hydroelectric power plant capacity, reservoir capacities and a water distribution pattern were optimized by use of draft-storage-frequency analysis and the resulting draft-storage curves. (Kriss-Cornell)
W71-02088

A TWO-STEP PROBABILISTIC MODEL OF STORAGE RESERVOIR WITH CORRELATED INPUTS,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 04A.
W71-02090

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
J. C. Flinn, and J. W. B. Guise.
Water Resources Research, Vol 6, No 2, p 398-409, April 70. 12 p, 8 tab, 30 ref.

Descriptors: *Mathematical models, *Equilibrium, *Water allocation (Policy), *Pricing, *River basin, *Optimization, Economics, Physical properties, Water demand, Social needs.
Identifiers: Quadiatic programming model.

The interregional equilibrium models developed by Takayama and Judge may be adapted to determine the efficient allocation and pricing of water in a river basin. The model assumed that a river basin authority acts as the sole public utility distributor of water over time and that the capacity to supply water within any time period may be constrained by the physical structure of the system. The physical structure of a hypothetical river basin was depicted and it was assumed that five regions competed for water stored in a headworks reservoir. The price policy sought for the river basin was that which maximized social welfare in relation to the regulated water supplies. Such a criterion is complex and therefore Marshallion concepts of consumer and producer surplus as an economic approximation to social welfare was used to simplify the approach. Two different types of information were required to test the proposed quadratic programming model; economic data and physical data. Data used pertained to water demand schedules, agricultural, industrial and urban demand for water, assumed transfer and processing costs, and physical characteristics of the water delivery system. Estimated water prices, which maximize social welfare in relation to the water supply to all regions for the four seasons of the year, were listed as well as the quantities of water allocated to each region over the year. Limitations and implications for research from this model were discussed. (Kriss-Cornell)
W71-02091

A STEADY STATE OPTIMAL DESIGN OF ARTIFICIAL INDUCED AERATION IN POLLUTED STREAMS BY THE USE OF PONTRYAGIN'S MINIMUM PRINCIPLE,
Rutgers - The State Univ., New Brunswick, N.J.; and Electronic Associates, Inc., Princeton, N.J.
For primary bibliographic entry see Field 05G.
W71-02095

STOCHASTIC IRRIGATION PLANNING MODELS,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
Douglas V. Smith.
A report to the East Pakistan Land and Water Study, Center for Population Studies, Harvard Univ, Jan 1970. 153 p, 19 fig, 24 tab, 115 ref, 5 append.

Descriptors: *Optimization, *Stochastic processes, *Linear programming, *Mathematical models, *Planning, Irrigation design, Economics, Physical properties, Hydrology, Water allocation (Policy).
Identifiers: Algorithm, East Pakistan.

A series of models and solutions algorithms that considered land and water allocation under stochastic economic and hydrologic conditions were developed. The basic deterministic model emphasizing the interactive consequences of the water demands of potential irrigated lands and the alternative water control possibilities that are present in most situations were discussed. Cropping patterns were selected by the model as well as economic implications of water-balance components which figured prominently in the model's formulation. The basic model was solved using a linear programming algorithm, and post-optimality analysis was performed. Stochastic parameters were introduced into the model and general distribution functions, variable capacities, pricewise linear decision rules, and stochastic demands and supplies were constraints dealt with. A sequence of models was constructed and solved with general conditions in mind and with East Pakistan conditions in mind. The first was deterministic, as a set of decisions for initial investment and yearly operations were determined using exante information. The second employed decision rules expressing canal diversions and well pumpages as linear functions. The final model considered streamflow and precipitation to be stochastic and well pumpages and canal diversions to be responsive to available streamflow as well as to irrigation water requirements. Some suggestions for further research were given. (Kriss-Cornell)
W71-02096

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06C.
W71-02107

MATHEMATICAL MODELS OF LOCATION: A REVIEW,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
David H. Marks, Charles S. ReVelle, and John C. Liebman.
In: Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 96, No UP1, p 81-93, March 1970. 17 ref.

Descriptors: *Mathematical models, *Model studies, *Analytic techniques, Systems analysis, Operations research, Land use, Planning, Methodology.
Identifiers: *Models of location, Private sector models, Public sector models.

Recent models of location are drawn together and compared as to structure, criteria, and constraints. Private sector models are distinguished as those in which the total cost of transport and facilities is isolated as the objective to be minimized. The solution techniques of six such models are presented. Public sector models are characterized by a criterion function involving a surrogate for social utility and by a constraint on investment in facilities or on the number of facilities. Five models with this format are described and compared. The two types of program, location in the private sector and location in the public sector, are seen to have the same conceptual foundation, but have formats which necessarily differ due to the inability to relate social utility to dollar value. (Miller-Chicago)
W71-02111

CHAPTER III: SYSTEMS ANALYSIS, A SUBSTITUTE FOR PLANNING.
For primary bibliographic entry see Field 06B.
W71-02123

SYSTEMS ANALYST'S VIEW OF NOISE AND URBAN PLANNING,
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
Martin Wachs, and Joseph L. Schoffer.
Journal of the Urban Planning and Development Division, Proceeding of the ASCE, Vol 96, No UP2, p 147-159, October 1970. 1 fig, 9 ref.

Descriptors: *Systems analysis, *Analytic techniques, *Planning, City planning, Methodology.
Identifiers: *Noise.

The problem of noise in urban areas is amendable to solution by the control of locational activities or by technological solutions located at the source of noise, at the receiver, or between the source and receiver. Some basic concepts of systems analysis may be used to determine informational requirements to make planning with respect to noise more realistic and more effective. These techniques can be applied to metropolitan water resources management as well. (Davis-Chicago)
W71-02145

SECTION II: WATER QUALITY AND HYDRAULICS.

In: Lake Michigan Development Proposal, Prepared by Project in Planning and Design Class, Department of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois, May 1969, p 4-33. 8 fig, 7 tab.

Descriptors: *Water quality, *Dike, *Sewage, Management, Waste dilution, Treatment, Cities, Intakes, Turbidity, Filtration, Algae.
Identifiers: *Sanitary canal, Metropolitan sanitary district.

The management of the water quality of the lake is looked upon as a complex problem, which can be approached in a number of ways. The emphasis in this part is on the construction of a dike or barrier to isolate the badly polluted southern portion of the lake with discussion of the present pollution problem, the benefits to be accrued with a barrier, construction factors, and the variety of ways it could utilized by the public and private sectors. Also investigated are the possible interrelationships with a proposed new airport on the lake, the Metropolitan Sanitary District, and relationships with urban and industrial areas in Northern Indiana. (See also W71-02156). (Miller-Chicago)
W71-02157

SECTION III: ALTERNATIVE PLANS.

In: Lake Michigan Development Proposal, Prepared by Project in Planning and Design Class, Department of Civil Engineering, The Technological Institute, Northwestern University, Evanston, Illinois, May 1969, p 34-82. 2 tab, 24 fig.

Descriptors: *Water quality, *Hydraulics, *Dike, *Construction materials, *Costs, Lake beds, Supply, Airport, Navigation, Harbors, Recreation, Lake Michigan, Tunneling, Bridges, Solid waste, Islands.
Identifiers: *Lake airport, *Dike expressway, Mass transportation, Monrail.

In this section three alternative plans are discussed, all of which provide a dike for managing the water quality of the lake and which will also provide a large Illinois-Indiana harbor area. These three alternatives present varying degrees of additional benefits and an opportunity for stage construction. The three alternatives are: (1) A minimum dike section; (2) a causeway wide enough to accommodate a highway and rapid transit facilities; and (3) two large islands approximately one-half mile wide at their greatest width. Also, discussed are features typical to all alternatives. The section ends with an over-all summary of the proposal in general. (See also W71-02156). (Miller-Chicago)
W71-02158

6B. Evaluation Process

AN ECONOMIC REAPPRAISAL OF THE TOLEDO BEND MULTIPLE-PURPOSE PROJECT,
Louisiana Water Resources Research Inst., Baton Rouge.
L. H. Falk, and W. J. Stober.
Available from NTIS as PB-195 825, $3.00 in paper copy, $0.95 in microfiche. Louisiana Water Resources Research Institute, Bulletin No 7, Oct 1970. 36 p, 6 tab, 16 ref. OWRR Project A-012-LA (2).

Descriptors: *Cost-benefit analysis, *Multiple-purpose projects, Interstate compacts, Resource allocation, Financing, Hydroelectric power, Taxes, Economics.
Identifiers: *Toledo Bend Reservoir, *Louisiana, *Texas, State taxes, Federal income tax.

Two of the outputs of the Toledo Bend Dam and Reservoir of Louisiana and Texas--hydroelectric power and water supply--could be provided in the private sector. The private costs avoided, therefore, constitute the basic benefits for comparison with the costs of these functions to ascertain economic feasibility. This study examines only the hydroelectric power aspect of the multiple-purpose project. The cost estimates, but not the methods, of the original feasibility study have been used in re-examining project benefits and costs. Benefit-cost ratios are computed from three view-points: (1) that of the power companies purchasing the Toledo Bend output, (2) that of the two states which build the project, and (3) that of the nation as a whole. It is concluded that direct power benefits justify the costs reasonably allocated to power from the standpoint of the power companies and the two states. From the national standpoint, however, the power phase of the project appears unjustified. The bias favoring construction by local interests is a consequence of their ability to shift a portion of the costs to the nation as a whole. The explanation is found in the tax structures and in disparities among discount rates.
W71-01652

SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION, SAN JUAN COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01653

LAND CLASSIFICATION FOR IRRIGATION, CURRY COUNTY,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 03F.
W71-01654

AREAWIDE SEWERAGE MASTER PLAN REPORT: PHASE I - INVENTORY SUMMARY REPORT.
Denver Regional Council of Governments, Colo.
For primary bibliographic entry see Field 05D.
W71-01679

THE RELATIONSHIP BETWEEN LAND VALUES AND FLOOD RISK IN THE WABASH RIVER BASIN.
Army Engineer Inst. for Water Resources, Alexandria, Va.

Available from NTIS as AD-704 717, $3.00 in paper copy, $0.95 in microfiche. Army Engineer Institute for Water Resources, 1 WR Report 69-4, December 1969. 117 p.
Identifiers: *Rivers, Floods, *Floods, Economics, Terrain, Production, Agriculture, Protection, Costs, Data processing systems, Selection, Regression analysis, Mathematical models, Programming (Computers), Indiana, Illinois, Ohio, Maps, *Flood risk, Land reclamation, Flood plains, Agricultural economics, *Wabash River, *Flood control.

The report examines the usefulness of using the differential in the value of land of similar productive characteristics on the flood plain and in the upland areas as a measure of the benefits accruing from the provision of flood protection to agricultural areas. A theoretical model is produced and applied to two reaches of the Wabash River and one reach of the White River. The three reaches represent three different topological and flood plain width combinations. The results of the land-value approach are compared with benefit estimates prepared previously using synthetic hydrology. The results of the analysis indicate that while the land-value approach cannot be universally applied there is a considerable range of topological conditions under which the approach offers a viable alternative to current procedures.
W71-01686

COMMENTARY IN SOVIET PERIODICALS ON ENVIRONMENTAL POLLUTION,
Joint Publications Research Service, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-01688

PLAN FOR PUBLIC SEWERAGE FACILITY DEVELOPMENT.
Rhode Island Statewide Comprehensive Transportation and Land Use Planning Program, Providence.
For primary bibliographic entry see Field 05D.
W71-01700

URBAN HYDROLOGY,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 04C.
W71-01822

NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA,
Rural Affairs Study Commission, Richmond, Va.
For primary bibliographic entry see Field 03B.
W71-01878

SUMMARY OF NATURAL RESOURCES IN THE COMMONWEALTH OF VIRGINIA.
Rural Affairs Study Commission, Richmond, Va.
For primary bibliographic entry see Field 03B.
W71-01879

VOLUNTARY PRIVATE BEHAVIOR AS A MEANS TO REDUCE CONSUMER HEALTH HAZARDS AND ENVIRONMENTAL POLLUTION,
Brookings Institution, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-01880

WATER SUPPLY AND POLLUTION CONTROL PLANS FOR VOLUSIA COUNTY, FLORIDA.
East Central Florida Regional Planning Council, Titusville.
For primary bibliographic entry see Field 05D.
W71-02050

A PRELIMINARY STUDY OF THE COST OF TUNNEL CONSTRUCTION,
Road Research Lab., Crowthorne (England).
For primary bibliographic entry see Field 08A.
W71-02053

COST-EFFECTIVENESS ANALYSIS OF CIVIL ENGINEERING SYSTEMS: NEW YORK CITY'S PRIMARY,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Richard de Neufville.
Massachusetts Institute of Technology, Dep of Civil Eng, April 1970. 26 p, 6 fig, 1 tab, 16 ref.

Descriptors: *Cost-benefit analysis, *Water supply, *Civil engineering, Planning, Design, Public Utilities.

A methodology for cost-effectiveness studies of civil engineering was proposed and illustrated by an example of its application to an urban systems problem. The approached tried to bridge the dichotomy of objectives which often exists between the policy levels of government and the engineering agencies, and which leads to frequent impasses for implementation. This five-stage analysis process attempted to broaden the traditional terms of reference for the design of public works, which are usually governed by engineering standards only tenuously related to the multiple objectives of a facility. A procedure was suggested for the generation of alternative configurations of the system and its components. A means was presented for the ex-

ploration of alternative time-phased strategies of development. A case study of the application of this approach to the planning and design of New York City's Third City Water Supply Tunnel was presented and its lessons were discussed. (Kriss-Cornell)
W71-02083

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06A.
W71-02091

SOFT WATER SUPPLY FOR URBAN CONSUMPTION, A FEASIBILITY STUDY,
Tahal - Water Planning for Israel Ltd., Tel Aviv.
For primary bibliographic entry see Field 05F.
W71-02106

TOTAL DOLLAR BENEFIT OF WATER POLLUTION CONTROL,
Syracuse Univ., N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02116

CHAPTER II: PREPARATION OF REGIONAL, BASIN AND STATE PLANS,
William Whipple, Jr., Ernest A. Englebert, and Warren L. Trock.
In: Evaluation Processes in Water Resources Planning, Urbana, American Water Association, June 14-19, 1970, p 11-25. 17 p, 5 fig, 3 tab.

Descriptors: *Regional development, *Model, *Planning, *State governments, Landscape, Resources, Hydrology, Analysis, Dynamics, Research facilities, Systems, Water resources, Environment, River basin.
Identifiers: *Regional plans, *Basin plans, *State plans, *Devices, *Needs, *Dynamic optimizing models, *Environmental quality, *Regional development, National efficiency, Biological stress analysis, Stress dynamics, System stimulation, Landscape classification system, Landscape values.

In water resources planning, there is a wide range of objectives and alternatives, but practical limitations narrow relations to a few choices. In the North Atlantic Region, consistent with the guidelines issued by the Water Resources Council, three objectives were selected: (1) environmental quality, (2) regional development, and (3) national efficiency. The three objectives could be considered components of practically all the objectives that could reasonably be postulated and three plans can be used to form the basis of a mixed objective plan. Plan formulation is the relating of three components: (1) the needs, (2) the resources, and (3) the devices, which bridge the gap between needs and resources. Two studies are mentioned because of their innovative nature. One is a study of urban growth by the Regional Plans Association of New York, the other deals with visual and cultural values and was conducted by the Research, Planning and Design Associates of Amherst, Massachusetts. The comprehensive State Water Plan for Nebraska is discussed as an example of the types of activities the States, generally, have been encouraged to undertake. Next, the preparation of regional plans is taken up with emphasis on types of research required. Then preparation of State plans is considered with a discussion of the roles of states, and the question of whether or not the conception and practice of planning is truly comprehensive. Following this is a discussion of dynamic optimizing models for comprehensive river basin planning, including state of the art and direction for research. (See also W70-09369) (Miller-Chicago)
W71-02122

CHAPTER III: SYSTEMS ANALYSIS, A SUBSTITUTE FOR PLANNING.

In: Evaluation Processes in Water Resources Planning, Urbana, Illinois: American Water Resources Association, June 14-19, 1970, p 26-40. 15 p, 1 tab.

Descriptors: *Systems analysis, *Planning, *Great Lakes, *Water quality, Limnology, Model, Water resources, Regression analysis, Benefit, State government, Linear programming, Simulation, Optimization.
Identifiers: *Multiple objective problems.

Presently there are several definitions and overlaps in terminology when discussing systems analysis. Here it is defined as a general concept involving the study of a specified portion of the universe. Historically, it had its beginnings in 1953 in water resources. Currently there are three approaches to measure benefits in multiple objective problems: (1) In the table of National Objective Accounts in Water Resources Council's 'Blue Book,' a table emphasizes the comparison of alternative plans in terms of their multiple objective effects; (2) represented by multiple-objective feasible solutions using a transformation curve with different forms of net benefits; together with social indifference (preference) curves; and (3) the depiction of the parties who gain and lose from different project alternatives including all of the significantly affected groups. There are problems in both the application of systems analysis to certain problems and the technique not being used to its greatest effectiveness in water resources planning. Also, there is a gap between the techniques and those who might make use of it. In terms of objectives and restraints in water resource planning, one can contrast what systems analysis can constitute with the actual nature of the water resources problem. Studies in the Great Lakes are given as examples of modeling techniques in water quality problems. Taken up next is systems analysis in State water problems, and some problems of systems analysis in water quality management. Communities want to incorporate environmental quality and efficiency objectives into planning and operations, when there is assurance of benefit to them and means, politically and institutionally, to accomplish this goal. (See also W70-09369) (Miller-Chicago)
W71-02123

CHAPTER IV: OPTIMUM INVESTMENT IN WATER POLLUTION CONTROL.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 41-56. 17 p.

Descriptors: *Investment, *Control, *Pollution abatement, *Optimization, Bioassy, Economic feasibility, Social aspects, Analysis, Systems analysis, Biochemical oxygen demand, Model, Conservation, Simulation, Basin, Cost, Federal project policy, Planning, Cities, State governments, Regional analysis, Leadership, Water quality, Effluents, Evaluation.
Identifiers: *Optimum investment, *Gaming, *Simulation gaming, Chicago.

The chapter includes (1) meaning of optimum, (2) our ability to describe and predict physical, chemical and biological effects of pollution control actions, (3) social and economic objectives and constraints, and (4) implementation of solutions. The major question in preplanning is the purpose of river objectives and water's role in social, industrial and economic development. The intangible nature of some objectives makes formal optimization difficult. Modeling data requirements far outstrip data availability and needs adequate monitoring. Systems analysis and computer techniques provide powerful insights into how to analyze optimum investment problems. Applying these techniques meaningfully, capable of providing viable solutions, requires studies into how consumers perceive pollution, plus determining their objectives for a nonmarket collective good. Regional water quality control programs on paper appear more economically efficient than local programs and plants; but most regional programs are not politically acceptable. Then sub-optimum solutions need to be implemented. As to research needs, more questions were generated than answered. Simulation gaming presents a new technique for evaluating political and social values necessary to describe the objectives and constraints for optimization plus devising institutions to implement optimum investment programs. Operational evaluation procedures for determining improved water quality values for instream uses are needed to provide economic inputs for an objective function necessary for optimization analyses and to give the public a quantification of what it receives from investment. (See also W70-09269) (Miller-Chicago)
W71-02134

CHAPTER V, FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 57-73. 17 p, 2 tab, 1 fig.

Descriptors: *Flood insurance, *Flood plains, *Floods, Planning, Zoning, Cities, State government, Federal government, Floodways, Flood protection, Flood proofing.
Identifiers: *Flood plain management, *Flood plain regulation, Actuarial rate.

Site damage may outweigh economic advantages in developing flood plains. Well being and hazard to life must be incorporated into evaluations with environmental considerations. Regulations of flood plains appear to be accepted by government, by contractors, and considered within the urban framework. When done so, management opportunities expand giving rise to possible synergistic effects. Dealing with a flood plain, there are three approaches (1) flood protection, (2) flood plain regulations, and (3) resource planning. An example of insurance encouraging wise use of flood plains, by 31 May 1970 about 150 communities agreed to adopt land use and control measures, to be eligible for federally assisted flood insurance. Insurance promotes control, since rates decrease with installation of control works. The Federal Flood Insurance Program to 31 May 1970, declared 64 communities eligible. By June, 1970, another 100 were to be covered. Flood insurance studies as a basis for actuarial rates are complete for 25 areas. The 1953 Tennessee Valley Authority program for assisting communities in planning for flood damage abatement serves as a model. The new flood insurance program could begin with technological accuracy, but it is not being exploited. Subsidizing on a percentage basis could overcome excessive and unequal subsidies. There is unequal community treatment. In most Tennessee Valley communities small business flood insurance is not available and is a far more serious need than residential insurance. Zoning and insurance may be effective in regard to additional flood plain investment, but offer little to encourage change in existing situations. (See also W70-09369) (Miller-Chicago)
W71-02135

CHAPTER VI: SPECIAL PROBLEMS OF METROPOLITAN WATER RESOURCES ANALYSIS.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, p 74-88, 1970. 21 p, 5 fig.

Descriptors: *Metropolitan studies, *Resources, *Analytical techniques, *Return flow, Simulation, Model, Basin.
Identifiers: *Metropolitan water resources management, *Rural water resources management,

*Water as an organizing concept, Muskegon, Michigan.

As attention is focused on metropolitan areas there is a need to develop clear and workable distinctions between metropolitan water resource management and regional or rural water resource management. Then definitions, concenpts, and characteristics of metropolitan resource management are discussed. Considered next is water as an organizing concept. The disadvantages of single-purpose strategies and the power of complex management strategies are compared. In terms of a metropolitan waste management system, there has been a lag in new technology implementation of as much as 50 years between development and widespread application. The Muskegon County, Michigan, wastewater management plan is used as a case example to present methodology for implementing new wastewater management technology in a metropolitan area. An important feature of the Muskegon plan was the community involvement and education program. Water here served as an organizing concept to a great advantage. Taken up next is wastewater irrigation planned through computer simulation. Then water resources planning in urban-metropolitan areas and recommendations for further research are discussed. (See also W70-09369) (Miller-Chicago)
W71-02136

CHAPTER VII: POLITICAL AND INSTITUTIONAL ASPECTS OF THE EVALUATION OF WATER RESOURCE PROGRAMS.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 89-100. 11 p.

Descriptors: *Water resources, *Evaluation, *Political aspects, *Institutions, *Decision making, Shores, Legislation.
Identifiers: *Water institutions, *Public actions.

Program evaluation for water resources planning purposes may be defined as the development and weighing of information that bears on the choice among alternative programs. Water institutions were divided into two broad categories: (1) the set of governmental regulations, laws, policies, and programs, influencing the evaluation process of private enterprise; (2) public agencies providing water services, laws, regulations, etc., determining the behavior of these organizations. Attention is focused on private decision making related to shorelands. Most shorelands are privately owned. As a result, the decisions of private entities have an important bearing upon the benefits society derives from its water resources; and, under existing institutional arrangements, shoreland cannot serve the interest of the public. This idea is considered in hypothetical form. Then, in a similar manner, municipalities are considered; and the possibility of governmental intervention to correct deficiencies. Considered next are alternatives for public action. Recommendations for a substantial variety of research are made. Also, noted is the need for further examination of the techniques of cost sharing so as to develop methods of implementing more equitable cost sharing arrangements. (See also W70-09369) (Miller-Chicago)
W71-02137

CHAPTER VIII, MULTIPLE-OBJECTIVE PLANNING, BENEFIT-COST ANALYSIS AND DISCOUNT RATE.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 101-118. 20 p, 2 fig.

Descriptors: *Planning, *Cost-benefit analysis, *Discount rate, *National income, *Income analysis, *Interest rate, Basin, Evaluation, Federal government, Environmental effects, Social aspects, Population, Public health, Benefits, Costs, Cost repayment.
Identifiers: *Multiple objective planning, *National economic development, *National income analysis, Task force, Regional development.

Plans for the use of the Nation's land and water resources should be directed to solutions of existing or projected resource needs or problems as identified by the desires of people in such a manner that optimal contributions would be made to society's preferences for national economic development, environmental quality, social well-being, and regional development. Also, the objectives are listed. Then discussion centers on benefits and costs; plan formation, and a proposed procedure for multiple objective planning. The national income concept of benefit-cost analysis is discussed and it is brought out that it provides a valuable service in separating out the components of benefits and costs in the national income framework. Following the discussion of discount rate and interest rate, attention turned to such topics as reimbursement policy; the question of multiple objectives in an economy in which there is a widespread and official commitment to economic growth; and the question of the identification and classification of environmental quality areas. (See also W70-09369) (Miller-Chicago)
W71-02138

CHAPTER IX, EVALUATION OF ENVIRONMENTAL AND REGIONAL EFFECTS.

In: Evaluation Processes in Water Resources Planning (Urbana, Illinois: American Water Resources Association), June 14-19, 1970, p 119-134. 16 p.

Descriptors: *Evaluation, *Environmental effects, *Regional analysis, *Water resources development, *Economic impact, *Surplus water, Planning, Input-output analysis, Preservation, Landscaping, Water resources, Water management, Project planning.
Identifiers: *Environmental quality, Inter-regional competition, Environmental values, Cultural qualities-resources, Visual qualities-resources, Protection needs, Development needs, Wilderness, Ecological research, Environmental quantification, Esthetic classification.

Water resource investments vary in their ability to affect the levels and mix of economic activity and the income results of that economic activity in the investment region and elsewhere in the Nation. An immediate challenge is the level of our understanding of these effects. Distribution of the effects of investments within the region of the investment and between it and elsewhere is more amenable to analysis than past inclusion of such analysis in evaluation reports would indicate. Choice of region and the character of participation in the process by those groups concerned with regional effects would seem to be crucial to the development of acceptable estimates of effects. Evaluation of environmental effects is not as clear as regional effects. Planners need to know who cares about which environmental values and how they will influence the investment decision process. There is a lack of correspondence between the time frame for evaluation of biological systems and the engineering and economic values more familiar to planners. There is a lack of study of methodology. The intergroup conflict process of decision making does not leave the environmental issue to the technician within the agencies. Should water planners seek out and help organize environmentally concerned groups to help plan. New areas of research are needed, especially in regard to the decision making process and esthetic classification and environmental quantification. Discussion of priority areas of research on regional effects was covered last. (See also W70-09369) (Miller-Chicago)
W71-02139

CHAPTER X, DEVELOPMENT OF A RESEARCH PROGRAM ON THE EVALUATION PROCESS.

In: Evaluation Processes in Water Resources Planning Urbana, Illinois: American Water Resources Association, June 14-19, 1970, p 135-150. 16 p.

Descriptors: *Analytical techniques, *Evaluation, Planning, Water resources, Water development, Social needs, Population, Resource allocation, Cost-benefit analysis, Social aspects, Urban sociology.

The political and social climate for water resources planning and development has dramatically changed within the past five years. The Nation is undergoing a reassessment and recordering of national priorities, causing proposed schemes of water utilization and development to be more critically measured relative to other national needs. Based on the shift of political power from rural to urban areas, there has been a shift from resource-oriented water program to population-oriented water programs. The general dissatisfaction with water evaluation processes, particularly cost-benefit analysis, has led to the formation of new government agencies and reformation of others. The technical valuation process for water resources has become a burning political-social issue. The water resource evaluation process is characterized next, and it is indicated that conceptual outlooks, planning, and evaluation approach are substantially altered. Water planning development needs to be placed in a broader societal context so that new policies and strategies can be effective. Water can be an organizing vehicle together with other public functions, such as transportation, for real integration and change. The changes necessary are then discussed. The changes disciplines be brought into the water evaluation process, particual from the behavioral sciences. Then the research needs in the area of water resources evaluation are discussed in terms of objectives, institutions, and market effects. (See also W70-09369) (Miller-Chicago)
W71-02140

COMPUTERS IN FLOOD CONTROL PLANNING,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
L. Douglas James.
Proceedings, American Society of Civil Engineers, Journal of the Hydraulics Division, Vol 95, No. HY5, p 1859-1869, November 1969. 13 ref.

Descriptors: *Flood control, *Planning, *Computers, Optimization, Evaluation, Non-structural alternatives, Analytic techniques, Computer programs, Channel improvement, Land use, Flood-proofing.
Identifiers: *Flood control planning, Structural alternatives.

Federal agencies are required to seek the optimum combination of structural and nonstructural measures for flood control. Most procedures for systematic evaluation of all alternative combinations of structural and nonstructural measures are not feasible under current financial and manpower limitations. The only solution for complete evaluation is by means of the digital computer. Two flood control planning computer programs have been developed which select the optimum combination of channel improvement, flood proofing, and land use management by location within the flood plain and by time. The second program adds detention storage to the list of available alternatives. Both incorporate the entire planning process from the raw data to a selected optimum program of measure use in one run. The programs have been applied to several flood hazard areas in California and Kentucky. (Davis-Chicago)
W71-02141

BASIC CONTEMPORARY URBAN PROBLEMS,
Illinois State Div. of Highways, Springfield.

Felipe V. Derteano.
Journal of the Urban Planning and Development Division, Proceedings of the ASCE, Vol 96, No UP2, p 133-145, October 1970. 13 ref.

Descriptors: *Planning, *Urbanization, *Social aspects, Aesthetics, Ethics, Cities, Community development, Urban sociology, Political aspects, Environment.
Identifiers: *Urban problems.

Urban developments have reached a state that calls for all enlightened persons to take a view, not as passive members of a society that evolves without their particaption, but as interested parties to the actual evolution. What is being observed in the political field has even more significant meanings in the social structure that man has created to lodge his culture. Society is changing, and when this occurs with the intervention of governments at different levels, it is time to see that fate, as never before in history, is in the peoples' hands. Governments are acting; but unless they be better-guided, may end in some complicated and inefficient bureaucratic scheme. Conversely, without aims, society will wind up the target of huge corporations bent only on making large profits in new ventures with government financing. Yet, people must intelligently surrender a misguided individualism and look for more social cohesion, if society is to remain as is. (Davis-Chicago)
W71-02144

PLANNING STANDARDS FOR STORM DRAINAGE,
Kansas City Public Works, Mo.
For primary bibliographic entry see Field 04A.
W71-02146

STATE FLOOD-PLAIN MANAGEMENT ACTIVITIES,
Oregon State Water Resources Board, Salem.
Jack G. Johnson.
Journal of the Hydraulics Division, ASCE, Vol 96, No HY10, Proc paper 7589, p 2041-2049, October, 1970. 4 ref.

Descriptors: *Flood control, *Flood plains, *Flood plain zoning, *Floods, *Hydraulics, Land use, Regulations, Rivers.

Although billions of dollars have been spent for the control of floods, it has been amply demonstrated that, on a nationwide basis, the effort to reduce flood damages is being lost. The flood control program's inability to maintain its early advantage is primarily attributable to rapidly increasing development on flood plains lands. The Tennessee Valley Authority pioneered the comprehensive flood damage prevention concept, portions of which have served as models for later endeavors by various states. Activities by 10 selected states in flood plain identification and management are cited as examples of the concept's past and continuing evolution. Most active state efforts are oriented toward providing adequate identification of flood plains and assisting local entities in implementing appropriate management of designated flood hazard areas. Technical, administrative, and legal problems are noted, as well as similarities to other social and economic needs of society. (Preckwinkle-Chicago)
W71-02147

PLANNING FOR PLEASURE BOATING ON REGIONAL BASIS,
Corps of Engineers, Seattle, Wash.
Ellsworth J. Gullidge, and Frank J. Uraback.
Journal of the Waterways, Harbors and Coastal Engineering Division, ASCE, Vol 96, No WW3, Proc paper 7453, August, 1970, p 583-600. 7 fig, 5 tab, 4 ref.

Descriptors: *Recreation facilities, *Boats, *Marinas, *Channels, *Planning, Navigation.
Identifiers: Moorings, Puget sound, Shipbuilding.

A regional study of Pudget Sound and adjacent waters, in Washington State, provided comprehensive information for use in planning of small boat harbors and other facilities required by pleasure boaters. This study included: an inventory of existing facilities and shoreline; measurement of marine facility demand by a questionnaire survey; comparison of demand with existing facilities to determine needs for additional facilities and projections of needs to 1980, 2000 and 2020. The paper displays a systematic approach towards the measurement of boater demand, both of quality and quantity, thus providing techniques for use by planners seeking to plan and develop facilities for pleasure boating. (Preckwinkle-Chicago)
W71-02148

STORM WATER FOR FUN AND PROFIT,
Chicago Univ., Ill. Center for Urban Studies.
John R. Sheaffer.
Water Spectrum, Vol 2, No 3, p 29-34, Fall 1970. 7 fig, 1 tab.

Descriptors: *Storm runoff, *Planning, *Environmental engineering, *Multiple-purpose projects, *Benefits, *Water supply, *Recreation, *Flood protection, Detention reservoirs, Retention, Storm water, Groundwater.
Identifiers: *Metropolitan resource management, *Closed systems planning, *Potential resources, *Open space.

A conceptual framework for storm-water management is presented illustrating in several case studies opportunites to capitalize upon a wide range of benefits. The three basic principles in the framework are: (1) the environment is a single unit with air, land, water and urban development interacting; (2) the earth for planning purposes is a closed system; (3) storm water is a potential resource out of place. The unity of the environment places storm water in a comprehensive perspective. Interchanges between surface and groundwaters and effects of urban land uses on distribution and quality must be recognized so that external costs will not affect drainage benefits. Considered within a closed system, the problem becomes one of space allocation. And viewed as a resource, location becomes an important factor. It is simply improper location that makes storm water a problem. When viewing storm water as a resource, quality must be carefully considered, particularly the initial flush which has been shown to be highly polluted. Therefore, a distinction must be made between detention and retention reservoir. When storm water is to be retained, it must be in an unpolluted condition or given treatment before storage. The six case studies discussed are: Storm water management at the Flick-Reedy plant in Bensensville, Illinois; Leetsdale-Oneida Apartment development at Denver; Howard Gulch flood control project in Denver; Skyline urban renewal project in Denver; Marcy Forest View Apartment development in Arlington Heights, Illinois; and the Indian Lakes storm drainage design in Bloomingdale, Illinois. All six cases illustrate in varying degrees the synergistic benefits of water supply, flood damage reduction, recreation, and open space. (Preckwinkle-Chicago)
W71-02150

COMMUNITY DECISION STRUCTURE AND URBAN PLANNING PROCESS,
Bureau of Public Roads, Washington, D.C.
Thomas J. Hillegass, Charles C. Schimpeler, and William F. Grecco.
Journal of the Urban and Development Division, Proceedings of the American Society of Civil Engineers, Vol 96, No UP1, p 17-22, March 1970. 1 tab, 9 ref.

Descriptors: *Planning, *Methodology, *City planning, *Decision making, Community development, Urban sociology, Political aspects, Social aspects, Attitudes, Social values.
Identifiers: *Community influentials, Community goals, Community objectives.

Professionals must be able to identify the power structure in a given community. If influential people are involved in the initial formulation of goals and objectives reflecting the broadly based value systems of the community, these same people will make the decisions, public and private, essential to implementing the adopted comprehensive urban plan. Community influence patterns are diverse and vary, in point in time, area of community interest as to whether influence is overt and direct, or indirect. Political scientists propose several means of identifying influential persons. These are position potential, issue examination, reputional technique, and social participation. A criterion for the selection of a committee to formulate community goals and objectives in a manner consistent with a broadly based community value system considers that the committee should consist of direct and indirect influentials, including public officials and representatives of commerce and industry, who are directly influential in controlling development decisions; and those indirect influentials who by reason of their personal stature and demonstrated interest are effective in shaping policies on important community issues. (Davis-Chicago)
W71-02152

URBAN PLANNING AND DEVELOPMENT OF RIVER CITIES,
Vollmer Associates, New York.
Arnold H. Vollmer.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol 96, No UP1, p 59-64, March 1970.

Descriptors: *Planning, *Cities, *Rivers, *City planning, Navigable waters, Conservation, Land use, Water pollution, Recreation.
Identifiers: *River cities, Metropolitan areas, Waterfronts.

The past provides a wealth of information testifying to the undeniable importance of locating cities on navigable bodies of water for purposes of trade, transportation, and protection. However, our present life style does not demand this same situation in order to grow and economically prosper. As man has evolved, so has his relationship to his environment, in this case his relationship to the waterfront. While the absolute necessity of waterfront location has become absolete, the sites themselves have become unsightly and neglected. Waterfronts, once the pride of the cities, have in many instances become the scars of the cities. As the demands for rivers as transportation and trade routes diminished, new demands evolved. The river became the transporter of sewage, the refuge of the pleasure seeker. The new demands often conflict with one another, yet they are of equal importance. While man's relationship to the waterfront is constantly evolving, function and esthetics are still key words in planning considerations. The aim must be progress in river city planning which will meet these demands and allow for order and meaning within the changing relationship between the river and the city. (David-Chicago)
W71-02153

THE STATE OF THE ART OF PLANNING,
Bartholomew (Harland) and Associates, Memphis, Tenn.
William S. Pollard, and Daniel W. Moore.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol 95, No UP1, p 27-42, April 1969. 7 fig, 10 ref.

Descriptors: *Planning, *Methodology, Systems analysis, Decision-making, Environment, Social aspects, City planning.
Identifiers: *Policy, *Inter-disciplinary teams, *Research, Operations research, Applied research.

The paper is based on a planning philosophy which attempts to deal with the total environment: social, economic, and physical. It describes the complex interrelationships among the many professions, so-

cial groups, and organizations involved in planning and suggests that an approach involving systems analysis and multi-disciplinary teams is required. Current planning practice is analyzed by means of a matrix which relates 43 kinds of planning studies with 28 technical steps required for their successful completion. The need for better techniques is emphasized for evaluating planning performance and to present a method for devising such techniques. Planning decisions are postulated and solutions to planning problems are sought mainly through one of the following approaches: (1) Policy; (2) judgement; (3) analysis and judgement; (4) operations research; and (5) applied research. (David-Chicago)
W71-02154

ACCESSIBILITY AND ENVIRONMENTAL QUALITY,
British Columbia Univ., Vancouver. School of Community and Regional Planning.
V. Setty Pendakur, and G. R. Brown.
Journal of the Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, Vol 95, No UP1, p 43-59, April 1969. 4 fig, 3 tab, 15 ref.

Descriptors: *Planning, *Environment, *Attitudes, Systems analysis, Social values.
Identifiers: *Environmental quality, *Accessibility.

A technique is outlined which could be of use in metropolitan water resources management, especially in the investigation of conflicting uses of the water resource. A systems framework is developed which portrays the components of the conflict between environmental quality and accessibility. Elements which serve to measure pedestrian safety, comfort, convenience and visual sensation are compared with those measuring motor vehicle driver safety, convenience, penetration and visual harmony. A pilot study was made, and pedestrian interviews conducted in an attempt to analyze perceptual responses to the environment. Two conclusions emerged from the study: (1) That it is possible to measure the environmental quality-accessibility conflict by attitude survey; and (2) that people are more consciously aware of problems of accessibility than of those of environmental quality. (Davis-Chicago)
W71-02155

LAKE MICHIGAN DEVELOPMENT PROPOSAL.
Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02156

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRICE, DEMAND, COST, AND REVENUE IN URBAN WATER UTILITIES.
Hittman Associates, Inc., Columbia, Md.
For primary bibliographic entry see Field 06D.
W71-01837

AN ECONOMIC STUDY OF THE EFFECT OF MUNICIPAL SEWER SURCHARGES ON INDUSTRIAL WASTES,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 05G.
W71-01897

ECONOMICS OF LIQUID-MANURE DISPOSAL FROM CONFINED LIVESTOCK,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 05D.
W71-02029

SWINE MANURE -- LIABILITY OR ASSET,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05D.
W71-02047

GUIDELINES FOR ESTABLISHING ECONOMIC AND ENGINEERING FLOOD CRITERIA,
Washington Univ., Seattle; and Washington State Univ., Pullman.
P. W. Barkley, D. L. Bender, H. D. Copp, J. G. Hattersley, and J. F. Osborn.
Commentary on Improving the Flood-Associated Activities of the State of Washington Dep of Water Resources Olympia, Report No 4, Part A, State of Wash. Water Research Center, Pullman, June 1970. 103 p, 18 fig, 8 tab, 2 append.

Descriptors: *Flood control, *Cost-benefit analysis, *Economics, *Flood damage, Hydrologic aspect, State jurisdiction, Washington.

The study described was designed to establish criteria for determining what portion of the costs for a flood control project for the State of Washington should be supported with State funds. Guidelines for establishing criteria to meet the needs of specific projects were described for flexibility and efficiency. An evaluation of past flood control activities by the State was provided. Recommendations were made to improve the efficiency of future flood damage alleviation activities. These recommendations included: (1) development of a state-wide, master policy and plan for flood damage alleviation; (2) initiation of a dynamic public information program on flood plain management; (3) approval of only local benefit projects; (4) requirement of more detailed information for entities requesting funds for flood projects; (5) enactment of zoning and land-use regulations governing the flood plain for counties and cities with flood problems; and (6) procedures for objective review of all projects. The recommendations were made on the basis of eighteen months of study. A brief history of the flood control division, flood damage reduction programs in other states, alternatives to the structural approach to flood damage reduction, the availability of hydrologic information and flood plain information studies and economic guidlines for evaluating project proposals and determining the level of state support were the topics discussed. (Kriss-Cornell)
W71-02079

THE ALLOCATION AND PRICING OF WATER IN A RIVER BASIN,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
J. C. Flinn, and J. W. B. Guise.
American Journal of Agricultural Economics, Vol 52, No 3, Aug 1970, p 411-421. 35 ref, 3 tab.

Descriptors: *Water allocation (Policy), Operating costs, Water rates, Equilibrium prices, Mathematical model, Cost analysis, Analytical techniques.
Identifiers: *Yanco Irrigation Area, Murrumbidgee Irrigation Area, New South Wales, Australia.

A spatio-temporal equilibrium model that incorporates intraseasonal demands for irrigation water is developed for the situation with a (constrained) competitive market for water. An application of the quadratic programming model, which utilizes demand and supply estimates relating to an intensive irrigation area in Southeastern Australia, is used to derive optimal short-run allocation and pricing patterns for the resource. Extensions of the model to cover multiple dam river basins and additional water uses seem conceptually straightforward, but the limitations imposed by its deterministic partial equilibrium character should be recognized. (Holmes-Rutgers)
W71-02107

ALLOCATING A LIMITED SUPPLY OF WATER FOR IRRIGATION,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 03F.
W71-02108

IRRIGATION WATER SUPPLY: EFFICIENCY AND COST ASPECTS,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02109

CHAPTER VIII, MULTIPLE-OBJECTIVE PLANNING, BENEFIT-COST ANALYSIS AND DISCOUNT RATE.
For primary bibliographic entry see Field 06B.
W71-02138

6D. Water Demand

PRICE, DEMAND, COST, AND REVENUE IN URBAN WATER UTILITIES.
Hittman Associates, Inc., Columbia, Md.

Available from the NTIS as PB-195 929, $3.00 in paper copy, $0.95 in microfiche. Hittman Associates, Inc Report HIT-474, September 1970. 106 p, 18 tab, 3 fig, 51 ref, 2 append. OWRR Project C-1790 (3168) (1).

Descriptors: *Water demand, *Water costs, *Water rates, *Elasticity of demand, *Economic evaluation, *Statistical models, Municipal water, Cost allocation, Public utilities, Regression analysis, Operating cost, Michigan.
Identifiers: *Rate-making policy, Detroit (Mich), Roseville (Mich).

The effects of rate-making policy on urban water utilities were investigated, including relationships between price, demand, cost, and revenue. The findings of other investigators were reviewed and analyzed, particularly estimates of the price elasticity of municipal water demands. Data were collected directly from 46 urban water utilities. Statistical methods were used to develop functional expressions for mean, maximum day, and peak hour demand; operating cost; and various classes of revenue. These functional expressions were incorporated into a general economic model of urban water utilities. Two case studies were performed using the economic model, based on data from Detroit and Roseville, Michigan. The case studies were used to illustrate the effect of a postulated rate increase on demand, cost, and revenue. Other applications of the economic model are described, including investigations of the distribution of demand, cost, and revenue among various classes of water users under alternate pricing strategies. Functional expressions for water demands were found to agree closely with those developed by other investigators. Operating cost functions and revenue functions incorporate correlations not previously reported. (Boland-Hittman)
W71-01837

LONG ISLAND WATER RESOURCES.
New York State Office of Planning Coordination, Albany.

Available from NTIS as PB-194 199, $3.00 in paper copy, $0.95 in microfiche. State Conservation Department Report, Jan 1970. 64 p, 16 tab, 15 fig, 35 ref. HUD Project No NYP 1/6.
Identifiers: *Water resources, New York, Regional planning, Groundwater, Water consumption, Water conservation, *Long Island water resources, Long Island.

The report discusses the unique problems of Long Island, stemming from its reliance upon a groundwater reservoir. Supplemented by tables, maps and graphs, the text explains available supplies, man-made problems which influence supplies, present and future water demands for diverse purposes and alternative methods of meeting future demands. Also included are sections from the State Conservation Law, describing the procedure for forming a regional water resources planning board.

W71-01988

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06A.
W71-02091

STOCHASTIC IRRIGATION PLANNING MODELS,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 06A.
W71-02096

6E. Water Law and Institutions

YOUNG V SCOTT (LIABILITY FOR OBSTRUCTION OF FLOW OF SURFACE WATER FROM DOMINANT ESTATE).

250 NW 484-486 (Iowa 1933).

Descriptors: *Iowa, *Dikes, *Diversion structures, *Surface runoff, Watersheds (Divides), Legal aspects, Judicial decisions, Remedies, Damages, Drainage, Drainage water, Riddance (Legal aspects), Concrete structures, Relative rights, Over-lying proprietor, Surface drainage, Obstruction to flow, Surface waters.

Plaintiff dominant estate owner sought an injunction to compel defendant servient estate owner to remove a dike which ran along the boundary line between their two tracts of land. Plaintiff contended that a dominant estate owner had a right to the unobstructed natural flow of drainage water from his land. Defendant contended that the dike had been in existence for forty years pursuant to an oral agreement between the parties. The Supreme Court of Iowa held that while it is well settled law that a dominant estate owner has a right to the unobstructed natural flow of drainage water from his land onto a servient estate, that right was overcome in the instant case upon sufficient proof of an oral agreement to erect a dike to drain the surface water in another manner. The trial court's judgment for defendant was affirmed. (Quesada-Florida)
W71-01655

A STUDY OF VARIOUS PROCEDURES UTILIZED BY SELECTED WATER-ORIENTED SPECIAL DISTRICTS WHICH ARE COMMON TO ALL OF THEM,
Washington Univ., Seattle. School of Law.
Beverly J. Rosenow.
Available from NTIS as PB-195 828, $3.00 in paper copy, $0.95 in microfiche. Completion Report. Resources Research Project No. A-030, Washington State University. 157 p, 8 charts, 3 append. OWRR Project A-030-WASH (1).

Descriptors: *Water-oriented special districts, *Commercial waterway districts, *Diking districts, *Flood control districts, *Flood control zone districts, Intercounty diking, Rehabilitation districts, *Public waterway districts, Governing bodies, Elections, Voter qualifications, Consolidation procedures, Reorganization procedures, Merger procedures, Dis-solution procedures. Uniform procedures act.
Identifiers: *Drainage districts, Drainage, *Water districts, Diking, *Sewage districts, Flood control, *Investigation districts, Public utility districts, Legislation, Water rights, Public rights.

This study analyzes selected common procedures prescribed by statute for several water-oriented special districts authorized in the State of Washington. Extensive differences were found in the procedures studies (formation, governing bodies, elections, consolidation, merger, reorganization, and dissolution). These differences are discussed in the text and reflected in accompanying comparative charts which summarize the governing statutes. It is concluded that development of uniform procedures in these areas is feasible. However, recommended as a better approach is creation of a single type of overall water management district authorized to carry out all of the water resource functions now spread among the man types of special districts with some jurisdiction in this area. Formation of a special commission to consider the feasibility of developing such broad legislation is suggested. In the course of gathering and anlyzing the special districts materials noted in this study, it was found that many efforts are being made to improve the structure of special district governments and that much more needs to be done to make the administration and operations of such districts more responsive and efficient. Suggestions are made for establishing a central record-keeping operation for all special districts presently existing in the state and for formation of a special districts association. Repeal of the never-utilized public waterway district legislation is recommended. (Rosenow-Washington)
W71-01657

MILLER V ZAHN (DOMINANT ESTATE'S LIABILITY FOR COLLECTION AND DISCHARGE OF SURFACE RUNOFF).

264 Mich 306, 249 NW 862 (1933).

Descriptors: *Michigan, *Drainage water, *Surface runoff, *Riddance (Legal aspects), Damages, Drainage systems, Concrete structures, Water management (Applied), Remedies, Legal aspects, Judicial decisions, Drains, Tiles, Tile drains, Impoundments, Impounded water, Land management.

Plaintiff servient estate owner sought to enjoin defendant dominant estate owner from collecting surface runoff and pouring it through an artificial ditch and tile drain onto plaintiff's servient estate. Plaintiff also sought to collect damages for water injury to his land. While conceding that a dominant estate owner had a right to have natural surface runoff flow onto the servient estate, plaintiff contended that this right could not be abused by increasing the burden on the servient estate through artificial collection and riddance. Defendant contended that the damage was due to an unusually heavy rainfall and denied that it was the product of the articial system employed by him. The Supreme Court of Michigan held that a dominant estate owner cannot, by collecting and concentrating the surface waters, abuse his lawful right to natural surface runoff. (Quesada-Fla)
W71-01661

BYRAM V LAWEIN (DISCHARGE OF SEWAGE WATER ONTO ANOTHER'S LAND).
232 NW 907-909 (SD 1930).

Descriptors: *South Dakota, *Sewage, *Riddance (Legal aspects), *Discharge (Water), Surface water, Septic tanks, Surface runoff, Surface drainage, Watercourses (Legal), Right-of-way, Railroads, Sewers, Land tenure, Culverts, Water pollution, Sewage disposal, Odor, Legal aspects, Judicial decisions, Wastes, Waste disposal, Overflow.

Plaintiffs sought to enjoin defendant from maintaining a septic tank near defendant's businesses and from discharging the overflow water from the tank onto plaintiffs' right-of-way. Plaintiffs proceeded upon two theories: (1) that the overflow from defendant's septic tank constituted a public nuisance; and (2) that defendant had no right to discharge water of any character upon plaintiff's land. The trial court denied the injunction. The South Dakota supreme court reversed. Plaintiffs were correct in their contention that defendant had no right to drain any water, other than the natural surface water, onto plaintiffs' right-of-way. The fact that defendant's discharge was minimal in quality and that the damage was also minimal did not authorized refusal of the injunction where the trespass was a continuing one. (Duss-Fla)
W71-01667

GREENFIELD V POWELL (TITLE TO ACCRETED PROPERTY).
118 So 556-559 (Ala 1928).

Descriptors: *Alabama, *Boundary disputes, *Boundaries (Property), *Accretion (Legal aspects), Streamflow, Real property, Land, Legal aspects, Judicial decisions, Stream erosion, Streams, Bank erosion, Running waters, Land tenure, Channels, Non-navigable waters, Relative rights.

Plaintiff and defendant owned property separated by a non-navigable stream. The course of the stream changed over a period of time, decreasing the area of plaintiff's property as bounded by the stream. Defendant claimed title to the property, which was previously plaintiff's, as accretion to his land. Plaintiff claimed the description in defendant's deed limited his property to a certain section of land, and that insofar as the allegedly accreted property extended over the section line, it was not defendant's. The Supreme Court of Alabama reversed a judgment for Plaintiff, finding that the stream in question changed course in a gradual manner consistent with accretion. Where a non-navigable stream is the boundary between adjacent landowners, each owner takes to the thread of the stream. Grants limited to a specific section of land may not by accretion be extended into another section, but the court found in the instant case that the description in defendant's deed did not limit his property to any specific section. (Dye-Fla)
W71-01668

STATE V TIMOTHY (DOCTRINE OF PURPRESTURE LIMITS PRIVATE CONSTRUCTION ON LAKE BED).
166 La 738, 117 So 812-814 (1928).

Descriptors: *Louisiana, *Ownership of beds, *Public rights, *Lake beds, Legal aspects, Judicial decisions, Remedies, State governments, Legislation, Lakes, Recreation facilities, Navigable waters, Engineering structures, Structures, Water rights, Social aspects, State jurisdiction, Regulation, Remedies.
Identifiers: *Purpresture.

Plaintiff state sued to require defendant to demolish a two-story bathhouse he had constructed 300 feet from shore on the bed of a state-owned lake. Defendant operated the bathhouse as a private business. Plaintiff argued that the common law doctrine of purpresture applied. Defendant contended the doctrine was limited to public things whose title is vested in the state, but not 'common things' which belong to no one, and which all men may use. The Supreme Court of Louisiana, in affirming a lower court decision for plaintiff, held that defendant could not invoke the statutory 'common things' protection because even if the lake bed were a common thing the permanent bathhouse was not a natural use contemplated by the statute. Since title to the lake bed rests in the state, it may sue to abate a purpresture or eject a trespasser on the public domain. (Morris-Florida)
W71-01673

GEISERT V CHICAGO R I AND P RY (SERVIENT LANDS MUST SUFFER CONSEQUENCES OF UNRESTRAINED FLOW OF DRAINAGE FROM DOMINANT ESTATES).

42 SW2d 954-957 (Mo 1931).

Descriptors: *Missouri, *Drainage practices, *Bridges, *Natural flow doctrine, Diversion structures, Damages, Ditches, Levees, Embankments, Drainage, Drain water, Culverts Natural streams,

Natural flow, Overflow, Missouri River, Land reclamation, Drainage districts, Sediment distribution, Accretion (Legal aspects), Alluvium, Excavation, Railroads, Judicial decisions, Legal aspects.

Plaintiffs landowner and corporation sought damages for injuries sustained allegedly as a result of defendant railroad's construction of a bridge over a creek and defendant landowner's digging of a ditch alleged to have altered the flow of the creek and increased the flow thereof onto plaintiffs' property. The court held that although one who diverts a watercourse from its natural channel must answer for damages, the alteration of the flow of the creek in the instant case was from natural causes. The court held further that defendant railroad had acted properly by constructing the bridge and allowing the water in its natural course to flow therethrough and that plaintiffs, as servient owners, had to suffer the consequences of the unrestrained flow of drainage onto their lands from dominant lands. The trial court's judgment for defendants was affirmed. (Price-Florida)
W71-01674

BOEHM V WERMUTH (DIVERSION OF STREAM FROM LANDOWNER'S PROPERTY).
215 NW 818-819 (Wis 1927).

Descriptors: *Wisconsin, *Streams, *Diversion structures, *Adjudication procedure, Alteration of flow, Natural flow doctrine, Obstruction to flow, Reasonable use, Relative rights, Water spreading, Judicial decisions, Legal aspects, Diversion.

Plaintiff riparian landowner sought a mandatory injunction against defendant upper riparian landowner. A stream divided into two courses on defendant's property, one course passing through plaintiff's tract. Plaintiff had obstructed the stream at this 'Y' division prior to defendant's purchase of his property, thereby diverting all the water through his land. After defendant's purchase, a flood washed this obstruction away, rediverting the stream back into the other course away from plaintiff's property. Defendant refused to permit plaintiff to enter upon his property to rebuild the obstruction, and plaintiff brought this action. Plaintiff contended that the trial court's fact findings were erroneous. Reviewing the evidence, the court affirmed the findings of the lower court, agreeing that defendant had no obligation to permit plaintiff to enter his property. (Hart-Florida)
W71-01677

EHLER V STIER (NULLIFICATION OF EASEMENT FOR DRAINAGE OF SURFACE WATER).
216 NW 637-639 (Iowa 1927).

Descriptors: *Iowa, *Surface drainage, *Easements, *Surface waters, Natural flow doctrine, Cities, Drainage systems, Flooding, Flood damage, Riddance (Legal aspects), Surface runoff, Drainage practices, Ditches, Water conveyance, Culverts, Roads, Judicial decisions, Legal aspects, Prescriptive rights, Relative rights.

Plaintiff landowner sought to enjoin defendant township from maintaining a culvert which drained surface water onto his property. Plaintiff's land and an adjoining owner's upper tract were separated by a road. Surface water drained from the upper tract through the culvert in the road and flooded plaintiff's land. Plaintiff's predecessor in title had obtained a permanent injunction prohibiting installation of the culvert, but a later predecessor had agreed orally with the adjoining landowner to ditch the road and to allow defendant to install the culvert. Plaintiff contended that the injunction prohibitied the ditches and culverts, while defendant alleged that a permanent drainage easement was created by plaintiff's predecessor, and that plaintiff received his property thus burdened. The court noted that if the drainage easement was permanent, it could not be nullified except by mutual consent. The previous owner's agreement was held to create a permanent easement which burdened plaintiff's estate at his purchase. The court summarily rejected plaintiff's assertion that the culvert size was restricted by the injunction, and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01682

SANDERS V DE ROSE (INJUNCTION TO PREVENT TRESPASSING UPON A PRIVATE LAKE).
191 NE 331-334 (Ind 1934).

Descriptors: *Indiana, *Lakes, *Ownership of beds, *Fishing, Sport fishing, Farm ponds, Recreation, Boundaries (Property), Water utilization, Competing uses, Nonconsumptive use, Legal aspects, Judicial decisions, Land tenure.

Plaintiff lake owner sought to enjoin defendant citizen from fishing and trespassing upon his lake. The lake, non-navigable and unconnected with navigable waters, lay almost wholly within plaintiff's boundary, except for a small portion lying within the adjoining private tract. Plaintiff operated a fishing camp on the lake. Defendant entered the lake with permission of the adjoining landowner, and refused to depart at plaintiff's request, asserting to plaintiff's customers that plaintiff did not own the waters of the lake above plaintiff's lake bed and could not charge them to fish in the lake. Plaintiff claimed control of the lake bed. The court noted that since plaintiff's lake-bed boundary was fixed by congressional survey, it was as certain as plaintiff's upland boundary. The common law was held to apply. Plaintiff had the right to unmolested use and control of his portion of the lake bed and the water thereover. Plaintiff's requested injunction was granted. (Hart-Florida)
W71-01685

VILLAGE OF ORRVILLE V GOCHNAUER (MEASURE OF DAMAGES FOR STREAM POLLUTION).
183 NE 391-393 (Ohio 1932).

Descriptors: *Ohio, *Water pollution, *Damages, *Compensation, Cities, Water pollution sources, Water pollution effects, Judicial decisions, Legal aspects, Adjudication procedure, Streams, Farms, Crops, Agriculture, Odor, Potable water, Cattle, Domestic animals, Poultry, Rent.
Identifiers: Orriville (Ohio).

Plaintiff farm owner sued defendant village for damages caused by pollution injury. Verdict and judgment were rendered for plaintiff. On appeal, defendant charged that the trial court had erred in failing to grant a judgment n.o.v. Defendant had queried the jury for special findings and had elicited a reply that rental value was not considered in reaching the verdict. To another question, the jury replied that the amount of damages awarded for foul odors from the polluted creek were $250. Defendant contended that these findings were inconsistent since the damages from odor could properly be established only by considering rental value. Furthermore, since the court had charged the jury that the measure of damages was the diminution in rental value, defendant asserted that the jury had failed to follow the court's instructions. After stating that a clear and irreconcilable conflict was required to overturn the verdict, the court held that such a conflict did not exist in the instant case. The court went on to hold that the questions of special findings were improper, and affirmed the lower court's decision for plaintiff. (Hart-Florida)
W71-01691

LYON V WATER COMM'RS OF CITY OF BINGHAMTON (RIGHT OF RIPARIAN OWNER TO FULL FLOW OF STREAM).

228 App Div 585, 240 NYS 647-654 (1930).

Descriptors: *New York, *Diversion, *Riparian rights, *Water demand, Prescriptive rights, Cities, Riparian land, Riparian waters, Diversion losses, Dams, Wells, Legislation, Judicial decisions, Legal aspects, Mills, Mill dams, Reservoirs, Water storage, Water supply, Damages, Remedies, Municipal water, Relative rights.

Plaintiff riparian owner and dam operators sought to enjoin defendant city from diverting water from the river above plaintiffs' dam. Plaintiffs' predecessor in title had legislatively secured the right to operate the mill dam on the river. Defendant had diverted the water because it was the only source of water for the city, and claimed a prescriptive right to such water diversion. The court ruled that plaintiffs, as riparian owners, had the right to enjoy the full flow of the stream. By wrongfully diverting the water, the city had gained no prescriptive rights thereto. However, since plaintiffs suffered no substantial damages, and since the river was the only source of supply for city water, the lower court's injunction against defendant was suspended until such time as plaintiffs suffered substantial damage. An award of nominal damages preserved plaintiffs' title and prevented defendant's securing prescriptive rights. (Price-Florida)
W71-01692

HAMMOND V ANTWERP LIGHT AND POWER CO (LIMITATIONS ON PRESCRIPTIVE RIGHT TO DIVERT STREAM FLOW).
132 Misc Rep 786, 230 NYS 621-639 (1928).

Descriptors: *New York, *Water utilization, *Prescriptive rights, *Water levels, Diversion dams, Relative rights, Riparian rights, Reservoirs, Lakes, Navigable waters, Diversion structures, Reasonable use, Prior appropriation, Damages, Remedies, Legal aspects, Judicial decisions, Consumptive use, Artificial use, Legislation.

Plaintiff lower riparian landowners sought to enjoin defendant power company from drawing water from its dam at the head of the stream upon which plaintiffs' lands abutted. Defendant maintained a dam at the mouth of the lake from which the stream flowed. Plaintiffs contended that while defendant might have acquired a prescriptive right to dam the water flowing from the lake outlet, it was restricted in the amount, manner, and purpose of such withdrawal. Plaintiffs further contended that defendant had not established a prescriptive right to diminish the flow onto the stream flowing through plaintiffs' lands. Defendant contended that it had acquired a prescriptive right both to dam the flow and to use the water for whatever purposes it chose. Additionally, defendant denied that it had impaired the flow onto plaintiffs' lands. The court held that when an upper riparian owner acquires the right to raise the water level to a certain height, other riparian owners acquire a reciprocal easement to have the water maintained at that height and used for the same purposes. (Quesada-Florida)
W71-01693

KNAUTH V ERIE RR (ACQUISITION OF PRESCRIPTIVE RIGHT TO DIVERT WATER).
219 App Div 83, 219 NYS 206-212 (1926).

Descriptors: *New York, *Streamflow, *Diversion, *Prescriptive rights, Relative rights, Riparian rights, Artificial use, Consumptive use, Water utilization, Diversion dams, Damages, Remedies, Legal aspects, Judicial decisions, Structures, Prior appropriation, Water levels, Adjudication procedure, Water demand.

Plaintiff lower riparian landowner sought to enjoin defendant upper riparian railroad from diverting water to the extent of depriving him of sufficient water to operate his mill. Plaintiff contended that he had forcibly removed defendant's dam before the passing of the required statutory period for defendant to establish a prescriptive right. Furthermore, plaintiff maintained that defendant had the burden of proving a prescriptive right to draw the

amount of water it was drawing at the time of the action. Defendant contended that it had so established a prescriptive right by reason of having diverted water without interruption for the statutory period. The court held that while a prescriptive right to divert the water of a stream may be acquired by uninterrupted diversion for the statutory period, defendant had the burden of proving such right by indubitable proof. Moreover, the court held that in order to establish a prescriptive right, there must have been appreciable diminution in the natural flow of the stream to the injury of the lower riparian owner from the beginning of the statutory period. The court held that defendant had not established a prescriptive right and affirmed the trial court's judgment for plaintiff. (Quesada-Florida)
W71-01696

STEVENS HOTEL CO V CHICAGO YACHT CLUB (ERECTION OF BUILDING AS BURDEN ON SCENIC EASEMENT).
399 Ill App 463, 171 NE 550-554 (1930).

Descriptors: *Illinois, *Scenic easements, *Riparian rights, *Lake Michigan, Lakes, Cities, Roads, Riparian waters, Buildings, Landfills, Easements, Judicial decisions, Legal aspects, Parks, Aesthetics, Land use, Scenery, Relative rights.
Identifiers: Chicago (Ill).

Plaintiff hotel owner sought to enjoin defendant yacht club from erecting a building on the shore of Lake Michigan. Plaintiff's hotel was situated on an avenue along Lake Michigan; a park extended to the lakeshore on the opposite side of the avenue. Plaintiff had an easement appurtenant in the park which prevented erection of buildings there. The city dredged in the lake bed adjacent to the park to a harbor line established by the Secretary of War. Defendant proposed to erect a clubhouse on land dredged in outside of this harbor line. Plaintiff contended that erection of the clubhouse would burden his easement. The court determined that plaintiff's easement extended throughout the dredged in portion of the park, as well as in the original park. However, the court found that plaintiff had no riparian rights other than those of the general public. Since the proposed site was beyond the harbor line to which plaintiff's easement extended, the court held that the easement would not be burdened by the new clubhouse, and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01724

NORTH-EAST COAL CO V HAYES (LIABILITY FOR DAMAGES TO FARM BY COAL MINE).

244 Ky 639, 51 SW2d 960-963 (1932).

Descriptors: *Kentucky, *Coal mines, *Damages, *Water pollution, Coal mine wastes, Water pollution sources, Hydraulic mining, Pollutants, Water pollution effects, Compensation, Reasonable use, Wells, Streams, Flooding, Soaking, Flood damage, Drainage systems, Judicial decisions, Legal aspects, Adjudication procedure, Farms, Property values.

Plaintiff landowner sued defendant coal mining company for damages caused by defendant's mining operation. Defendant, who owned the mineral rights to plaintiff's land, had allegedly caused three injuries to plaintiff: (1) an inadequate drain pipe caused water to run onto plaintiff's bottom land; (2) waste mining water polluted a creek which ran through plaintiff's property; and (3) plaintiff's well was contaminated. The court held defendant liable for injury from the inadequate drain. However, defendant was held not liable for the well pollution since the source of the pollution was underground, and therefore it could not have been avoided with reasonable care. As to the stream pollution, the court stated that if it could have been prevented by reasonable care, defendant was liable and remanded the issue for a new trial. The court determined that the measure of damages for temporary injury was the diminution in rental value, whereas the measure for permanent injury was the dinimution in fair market value. (Hart-Fla)
W71-01733

LOUISVILLE AND N RR V SALTZER (RAILROAD'S LIABILITY FOR BANK EROSION CAUSED BY REROUTING OF RIVER).
144 SE 456-458 (Va 1928).

Descriptors: *Virginia, *Railroads, *Rivers, *Bank erosion, Banks, Streamflow, Alteration of flow, Routing, Damages, Riparian land, Riparian waters, Erosion, Channel erosion, Construction, Diversion, River training, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff landowner brought action against defendant railroad to recover for erosion damage to his land caused when defendant, during construction, changed the course of a river running through plaintiff's property. Defendant raised the statute of limitations, contending that the cause of action arose in 1891 when construction was completed whereas plaintiff brought his action in 1923. Plaintiff contended that no erosion occurred until 1918. The court noted that, while plaintiff had the burden of proving damages, defendant had the burden of proving the facts supporting its statute of limitations defense. Finding that the conflicting evidence was properly submitted to the jury, the court affirmed the judgment for plaintiff. (Liptak-Fla)
W71-01744

AMERADA PETROLEUM CORP V LOUISIANA MINERAL BD (OWNERSHIP OF ROYALTIES FROM MINERAL LEASE IN STREAMBED).
203 La 473, 14 So 2d 61-72 (1943).

Descriptors: *Riparian rights, *Louisiana, *Accretion (Legal aspects), *Boundaries (Property), Bank erosion, Minerology, Drilling, Exploration, Legal aspects, Judicial decisions, Legislation, Oil wells, Oil industry, Oil reservoirs, Streambeds, Ownership of beds, Running waters, Streams, Leases, Royalties.

Plaintiff petroleum corporation, owner of an oil rights lease in a streambed, sought to interplead defendant state mineral board and a riparian owner, both of whom claimed the royalties under plaintiff's lease. Defendant mineral board contended that the royalties under the lease were rightfully due to it because the state held title to the streambed. Defendant riparian owner claimed the royalties on the theory that the oil was taken from accretion to which it held title as owner of the riparian lands adjacent to such accretion. The Supreme Court of Louisiana held that the portion from which the oil was taken was formed by accretion, and since such accretion was owned by the riparian owner and not the state of Louisiana, the riparian owner was entitled to the royalties from plaintiff's oil rights lease. (Quesada-Fla)
W71-01745

HEARINGS AND REPORT ON AMENDMENT TO THE WATERSHED AND FLOOD PREVENTION ACT BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONG, 2ND SESSION.
Hearings and Report--Subcomm on Conservation and Credit--Amendment to Watershed and Flood Prevention Act--Comm on Agriculture, US House of Representatives, March 9, 1964; Oct 19, 1965.

Descriptors: *Watershed Protect. and Flood Prev. Act, *Soil conservation, *Flood protection, *Multiple-purpose projects, Flood control, Floodwater, Conservation, Water storage, Administrative decisions, Recreation, Dams, Reservoirs, Reservoir storage, Wildlife conservation, Eminent domain, Right-of-way, Federal government, Legislation, Floodways.

The Subcommittee on Conservation and Credit of the Committee on Agriculture met on March 19, 1964, to consider H.R. 9938, proposing to increase the limitation on floodwater detention capacity from 5,000 to 12,500 acre-feet and H.R. 9695, likewise offered to amend the Watershed Protection and Flood Prevention Act. Appearing before the Subcommittee were several representatives of the Soil Conservation Service and state conservationists, who presented statements regarding the 5,000 acre-foot limitation of floodwater storage in an effort to evidence the need for the legislation under consideration. Also discussed were the cost factors to be involved in the implementation of the projects called for by the bills, and possible problems in land acquisition. A favorable report and recommendation as to H.R. 9149, a bill to amend the Watershed Protection and Flood Prevention Act was included. Section Two of the Act (68 Stat 666) was amended as recommended by the Committee on Agriculture. (Price-Florida)
W71-01751

GLORE V HAGGARD (IMPLIED EASEMENT TO MAINTAIN PIPELINE FOR EXERCISE OF WATER RIGHTS).
143 SE 780-781 (Ga 1928).

Descriptors: *Georgia, *Water rights, *Easements, *Pipelines, Right-of-way, Prescriptive rights, Water supply, Distribution systems, Damages, Legal aspects, Judicial decisions, Relative rights, Water contracts, Water utilization, Domestic water, Water distribution (Applied), Contracts.

Plaintiff landowner brought action against defendant landowner to recover damages caused when defendant dug up and removed water pipes on defendant's property, thereby cutting off plaintiff's sole water supply. Plaintiff contended that the pipes were laid on the property by the common grantor of both lots before the grantor divided his land for sale and that the conveyance from the common grantor included the right to continued use of the water system. The court noted that the former owner's use of the pipeline created an easement appurtenant to maintain the pipes in order to enjoy the water rights. The court held that such an easement could be conveyed by general words and need not be specifically mentioned in plaintiff's deed. The trial court's granting of defendant's demurrer was reversed. (Liptak-Florida)
W71-01753

ELLERSON FLORAL CO V CHESAPEAKE AND O RY (LIABILITY FOR FLOODING CAUSED BY EXTRAORDINARY RAINFALL).
141 SE 834-836 (Va 1928).

Descriptors: *Virginia, *Surface drainage, *Culverts, *Obstruction to flow, Surface runoff, Legal aspects, Judicial decisions, Drainage, Land, Adjudication procedure, Floods, Precipitation excess, Drainage water, Rain water, Small watersheds, Surface waters, Damages, Flooding, Ravines, Railroads, Rain, Excessive precipitation.

Defendant railroad maintained an elevated roadbed across a ravine which was the only outlet for the small watershed in which plaintiff's property was located. A 36-inch pipe passed through the roadbed. On three occasions the pipe proved inadequate for passage of surface waters following heavy rains. The consequent flooding resulted in damage to plaintiff's crops. Plaintiff sought damages for a permanent nuisance. Defendant contended that the rains causing the damage were so unusual as to constitute an act of God and that the first instance of damage had occurred more than 5 years prior to the action so that an action based thereon was barred by the statute of limitations. The court in reversing the trial court's judgment for defendant, held that the statute of limitations does not run until it may be definitely determined that the damage is permanent, which determination was made in this case on the date of the second instance of damage. No evidence showed that the pipe was adequate during foreseeable storms. The act of

God doctrine was thus not applicable. (Dye-Florida)
W71-01770

WASHINGTON WATER CO V PARRETT (DAMAGES FROM DAM OVERFLOW).
9 F2d 915-916 (6th Cir 1926).

Descriptors: *Dams, *Ohio, *Remedies, *Subsidence, Riparian land, Soaking, Submergence, Withdrawal, Overflow, Flood damage, Streams, Maximum probable flood, Damages, Adjudication procedure, Legal aspects, Judicial decisions, Flooding, Saturation, Water spreading, Floodwater, Impoundments, Water injury.

Plaintiff riparian landowner sought to enjoin defendant water company from maintaining a dam on a creek downstream from plaintiff's land. The trail court found that the dam caused a delay in subsidence of water from plaintiff's land, thereby injuring plaintiff's property slightly, and ordered defendant to either remove the dam or alter it to prevent water from backing up onto plaintiff's land. On appeal, the court held that the trial court's remedy was wholly disproportionate to plaintiff's injury and inequitable in consideration of defendant's large expenditure in the dam. Accordingly, the case was remanded for a determination of damages. (Hart-Florida)
W71-01811

BELLAIRE, BENWOOD AND WHEELING FERRY CO V INTERSTATE BRIDGE CO (BRIDGE CONSTRUCTION OVER NAVIGABLE STREAMS).
40 F2d 323-328 (4th Cir 1930).

Descriptors: *West Virginia, *Federal jurisdiction, *Navigable rivers, *Bridge construction, Federal government, Ohio River, Navigation, Bridges, Legislation, Construction, Channels, Streams, Public rights, Piers, Abutments, Easements, State jurisdiction, Navigable waters, Boundaries (Property), Judicial decisions, Legal aspects, Watercourses (Legal).
Identifiers: Ferries.

Plaintiff ferry operator sought to enjoin erection of a bridge over the Ohio River. The bridge was to be erected pursuant to a congressional act. Plaintiff sought to enjoin defendants from appropriating land claimed by plaintiff, from interfering with the franchise and rights of plaintiff's ferry, and from interfering with plaintiff's ability to navigate the river. Defendants had the action removed to federal court. They denied plaintiff's land was being appropriated, that he had any navigational rights in the river, or that he would be unlawfully interfered with by erection of the bridge. Defendants further alleged that the stream, as to navigation, was under control of the federal government and that the bridge was authorized by Congress. The federal district court dismissed the bill of complaint and the circuit court affirmed. The federal courts had jurisdiction because the erection of bridges over navigable waters involves the laws of the United States. The trial court was correct in dismissing the bill because the bridge was lawful, plaintiff's rights were not infringed, and none of plaintiff's land was appropriated. (Duss-Florida)
W71-01846

TWIN FALLS CANAL CO V AMERICAN FALLS RESERVOIR DIST NO 2 (DIVERSION OF UNAPPROPRIATED WATER).

59 F2d 19-25 (9th Cir 1932).

Descriptors: *Idaho, *Diversion, *Use rates, *Unappropriated water, Dams, Prior appropriation, Beneficial use, Diversion structures, Relative rights, Water utilization, Usufructuary right, Compensation, Legal aspects, Judicial decisions.

Plaintiff canal company constructed and operated a dam in the Snake River. The United States constructed a dam upstream from plaintiff's dam. Defendant reservoir district, under contract with the United States, diverted water for irrigation from the slack water between the two dams. Plaintiff contended that were it not for plaintiff's dam, the level of the slack water between the dams would be too low to allow effective diversion. Plaintiff sought to force defendant to compensate plaintiff for the use of plaintiff's dam. The court, in affirming a judgment for defendant, found that plaintiff's right to the water extended only to its beneficial use at the dam. The right to use unappropriated water remained in the upstream proprietors. (Dye-Florida)
W71-01861

BIRCH V BOSTON AND M RR (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH).
259 Mass 528, 156 NE 859-861 (1926).

Descriptors: *Massachusetts, *Flood damage, *Surface drainage, *Obstruction to flow, Ditches, Overflow, Water injury, Surface runoff, Surface waters, Cities, Railroads, Embankments, Drainage, Drains, Culverts, Saw mills, Millponds, Settlement (Structural), Subsidence, Legal aspects, Judicial decisions.

Plaintiff sawmill owner sued to compel defendant railroad to repair a drainage ditch and culvert and also sought to recover for damages caused by the overflow of the ditch after heavy rains. Plaintiff contended that the ditch was obstructed with silt, that it was too small, that the culvert was overgrown with grass and weeds and was even smaller than the ditch, and that both were insufficient to carry off the natural drainage of surface waters flowing into them. Defendant contended that the damage was due to plaintiff's neglect in not repairing the damage to his buildings and to increased flow of surface water from streets constructed by a nearby city. Affirming a judgment for plaintiff, the court held that, regardless of the source of the drainage water, it was the presence of defendant's inadequate ditch and culvert which caused the overflow and damage since it was not shown that the water from the city would have reached plaintiff's land but for defendant's ditch. The court also noted that defendant's liability could be abated by plaintiff's failure to make repairs. (Liptak-Florida)
W71-01871

BELCASTRO V NORRIS (DRAINAGE RIGHTS ACROSS ADJOINING PROPERTY).
261 Mass 174, 158 NE 535-536 (1927).

Descriptors: *Massachusetts, *Surface drainage, *Surface waters, *Relative rights, Ditches, Flow, Discharge (Water), Construction, Overflow, Surface runoff, Excavation, Damages, Land tenure, Riparian rights, Riparian land, Riparian waters, Watercourses (Legal), Legal aspects, Judicial decisions.

Plaintiffs sought to restrain defendant adjoining landowner from enlarging a ditch and to recover damages which resulted from the increased flow of water across their land occasioned by defendant's enlarged ditch. The trial court dismissed plaintiffs' bill, but the Supreme Judicial court of Massachusetts reversed. A landowner has the right to improve his land, and he is not responsible for damage caused by the natural flow of surface water incident to such improvement. However, a landowner cannot collect surface water into a ditch or artificial channel and discharge it on his neighbor's land. Plaintiffs were subject to the servitude of water running from ditches already constructed, but they could not be subjected to the servitude of an additional flow of water resulting in damage caused by construction of new and auxiliary ditches. Defendant could not drain his land by additional ditches if it increased the flow of water to plaintiffs' injury. Since exact damages could not be determined, plaintiffs were entitled to the injunction and nominal damages. (Duss-Florida)
W71-01873

HOGAN V PENNSYLVANIA RR (ALLEGEDLY INADEQUATE CONDUIT NOT PROXIMATE CAUSE OF FLOODING).
319 Pa 485, 181 A 447-448 (Pa 1935).

Descriptors: *Pennsylvania, *Conduits, *Railroads, *Backwater, Obstruction to flow, Topography, Discharge (Water), Watercourses (Legal), Damages, Runoff, Overflow, Natural flow, Culverts, Right-of-way, Flooding, Floodwater, Legal aspects, Judicial decisions.
Identifiers: *Causation (Legal).

Plaintiff landowner brought action against defendant railroad for damages to her property. The damage was allegedly caused by defendant's failure to maintain an adequate and unobstructed conduit under its tracks for discharge of waters from a natural watercourse. Defendant contended it was a physical impossibility for the flooding of plaintiff's land to have been caused by the inadequate conduit. The court found that the level of plaintiff's land was several feet higher than the level of the conduit and that, even if the passage of the conduit were completely obstructed, the water would not have flooded plaintiff's property. The water would have flowed over the conduit and into a nearby creek. For this reason the lower court's judgment of nonsuit was affirmed. (Price-Florida)
W71-01874

NATIONAL REAL ESTATE DEV CORP V LA VALE WATER CO (WATER RIGHTS AS EASEMENTS).

173 A 52-54 (Md 1934).

Descriptors: *Maryland, *Water rights, *Easements, *Land tenure, Reservoirs, Basins, Dams, Construction, Water utilization, Water supply, Conduits, Overflow, Springs, Pipes, Legal aspects, Judicial decisions, Adjudication procedure, Watercourses (Legal), Remedies.

Plaintiff corporation sued defendant water company in ejectment to recover alleged water rights. Both plaintiff and defendant had received deeds from a common grantor which conveyed water rights on a tract of land. The trial court granted defendant's motion for a directed verdict. The Court of Appeals of Maryland affirmed. Both deeds to plaintiff and defendant conveyed only certain water rights and privileges, and such rights and privileges were only easements. Therefore, if any rights of plaintiff were invaded, its remedy was an action on the case and not in ejectment. (Duss-Florida)
W71-01876

VOLUNTARY PRIVATE BEHAVIOR AS A MEANS TO REDUCE CONSUMER HEALTH HAZARDS AND ENVIRONMENTAL POLLUTION,
Brookings Institution, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-01880

FIDELITY UNION TRUST CO V COCHRANE (RIGHT TO USE OF PRIVATE LAKE).

172 A 800-803 (NJ 1934).

Descriptors: *New Jersey, *Easements, *Lakes, *Land tenure, Relative rights, Riparian land, Riparian water, Riparian rights, Ponds, Recreation, Public benefits, Judicial decisions, Legal aspects, Prescriptive rights, Public rights.

Plaintiff lake owner sought to enjoin defendant owners and occupants of summer cottages surrounding the lake from fishing, boating and bathing

in said lake. Defendant's claimed an easement of boating and bathing in the lake by adverse user of their predecessor in title and themselves for twenty years or more. The court found that defendants had not occupied the land long enough to comply with the state's adverse possession laws. Also, defendants took no such rights through their predecessors since their predecessors had no such rights. The predecessors never intended to adversely possess the rights claimed by defendants. The court held that plaintiff was entitled to the injunction sought. (Price-Florida)
W71-01886

PUBLIC POLICY AND SHORELINE LANDOWNER BEHAVIOR,
North Carolina Water Resources Research Inst., Raleigh.
Raymond J. Burby, III, and Shirley F. Weiss.
Available from NTIS as PB-195 926, $3.00 in paper copy, $0.95 in microfiche. North Carolina Water Resources Research Institute Report No. 38, July 1970. 126 p, 18 tab, 2 fig, 29 ref, append. OWRR Project B-012-NC (5).

Descriptors: *Reservoirs, *Reservoir sites, Reservoir construction, *Land development, *Land use, *Land ownership, Land management, Watershed management, North Carolina.
Identifiers: *Land use policy.

New residential development in reservoir shoreline areas begins with the decision of a landowner to sell individual sites to recreation consumers or acreage tracts to residential developers. While this first step in the residential development process is primarily facilitative in urban areas, it assumes central importance in reservoir areas where many landowners become intimately involved in the production and sale of residential sites. Environmental deterioration in reservoir areas is in large part due to the inexperience of these landowners turned land developers. Utilizing field data from fifty-eight interviews with predevelopment landowners in five multipurpose reservoir areas in North Carolina, the empirical analyses demonstrate the existence of significant relationships between landowner characteristics and landowner decisional outcomes. Tests based on multiple discriminant analysis indicate that these relationships can be expressed in a manner suitable for field level planning. The individual discriminant programs were able to classify correctly between 79.3 percent of the observations in the case of holders versus all sellers and 91.3 percent in the case of parcel sellers versus all other landowner types. The results of the combined discriminant program strongly suggest that a single landowner model can be developed to predict landowners who are most likely to hold, sell lots, subdivide, or sell to a developer. The strategic variables isolated thus far for an operational model of shoreline land owner behavior are the following five, in order of importance: (1) income from the land; (2) occupational interest in real estate; (3) residence on the land; (4) annual personal income; and (5) purpose of acquisition. The present study thus provides a beginning of an operational planning methodology for guiding shoreline development in multipurpose reservoir areas.
W71-01888

LINDENMUTH V SAFE HARBOR WATER POWER CORP (EASEMENT FOR FLOODING CAUSED BY DAM CONSTRUCTION).

309 Pa 58, 163 A 159-163 (1932).

Descriptors: *Pennsylvania, *Dams, *Easements, *Flooding, Rivers, Lumbering, Design flood, Maximum probable flood, Overflow, Water supply, Submergence, Land tenure, Judicial decisions, Legal aspects, Water injury, Relative rights, Damsites, Trees.

Plaintiff landowner sought to enjoin defendant water power corporation from flooding his land and from cutting trees on his land. Plaintiff's predecessor in title had granted to defendant's predecessor an easement to overflow plaintiff's land upon construction of a dam. This grant, which inured to heirs and assigns, included all rights necessary for full enjoyment of the easement. Defendant's intermediate predecessors built a dam downriver from the site originally contemplated and cut some trees to prevent them from drifting downstream after the flooding and injuring the dam. Plaintiff contended that: (1) the easement was in gross, and therefore unassignable; (2) by the terms of the grant, it was unassignable; (3) building another dam downstream exhausted the easement; and (4) the easement did not include the right to remove trees. Determining that the easement was appurtenant to the dam and that the grant expressly permitted assignment, the court held that defendant owned the easement. The court further held that the agreement specified no particular damsite and that removal of the trees was reasonably necessary for full enjoyment of the easement. The lower court's decision for defendant was affirmed. (Hart-Fla)
W71-01924

RICHARDSON V TUMBRIDGE (NON-USE OF EASEMENT NOT TANTAMOUNT TO ABANDONMENT).
149 A 241-244 (Conn 1930).

Descriptors: *Connecticut, *Easements, *Drainage, *Ditches, Riddance (Legal aspects), Drainage practices, Dams, Drains, Tile drains, Obstruction to flow, Judicial decisions, Legal aspects, Streams.

Plaintiff landowner sought a judgment that his land was no longer subject to a drainage easement granted by his predecessor in title to defendant's predecessor in title. Plaintiff contended that nonuse of the right to build a drainage ditch was tantamount to abandonment of such right. Defendant, as well as his predecessor, had chosen for drainage to use a natural stream that flowed through both properties in lieu of constructing the ditch. The court held that mere non-use of a deed-created easement was insufficient to establish abandonment. Before abandonment can be established, the owner must act so as to evidence an intention to abandon the easement. Defendant's conduct was found not to be inconsistent with his right to make use of the easement. Judgment for defendant was affirmed. (Price-Florida)
W71-01928

BURKE V BOSTON AND M RR (RAILROAD'S LIABILITY FOR DEATHS CAUSED BY ROADBED WASHOUT).
134 A 574-581 (NH 1926).

Descriptors: *New Hampshire, *Railroads, *Washouts, *Surface runoff, Embankments, Accidents, Damages, Land subsidence, Roads, Highways, Cities, Road construction, Diversion, Surface waters, Ditches, Culverts, Reasonable use, Diversion structures, Legal aspects, Judicial decisions, Adjudication procedure, Surface drainage, Repulsion (Legal aspects), Riddance (Legal aspects).

Plaintiff administrators brought actions against defendant railroad to recover for the wrongful deaths of three of defendant's employees who were killed when defendant's roadbed washed out and collapsed, resulting in a train wreck. The roadbed had long been protected by a highway which acted as a dam and diverted surface water away from the roadbed. Plaintiffs contended that defendant was negligent in not taking precautions against changed conditions after the highway had been reconstructed and failing to provide for surface water which crossed the highway and washed out the roadbed. Defendant contended that it relied on the continued protection of the highway absent any notice that the changes in the highway changed the direction or flow of the surface runoff and absent any obvious indications that the highway's protection had ceased. The court noted that defendant could not rely on the continuation of the highway's gratuitous protection, but was only responsible to make reasonable inquiry into changed conditions. Finding the lower court erred in not submitting defendant's requested instruction on the reasonable care standard, the court reversed and remanded for new trials the judgments for plaintiffs. (Liptak-Florida)
W71-01949

NICHOLS V FERNALD (UNREASONABLE USE OF FIRST RIGHTS IN SPRING).
131 A 836-837 (NH 1926).

Descriptors: *New Hampshire, *Preferences (Water rights), *Reasonable use, *Water pollution, Water rights, Springs, Competing uses, Legal aspects, Judicial decisions, Land tenure, Water utilization, Water users, Diversion, Potable water, Water supply, Water pollution sources, Animal wastes (Wildlife), Wastes, Relative rights.

Plaintiff and defendant owned adjacent property. Defendant's predecessor, plaintiff's grantor, had reserved the first use of water from a spring on plaintiff's property. Plaintiff sued to restrain defendant from interfering with plaintiff's right to use the water. Plaintiff contended that defendant made unreasonable use of the spring by allowing his cattle to feed there and pollute the spring. Defendant contended that plaintiff had interfered with the first use of the water by covering the spring and also used water for purposes other than those allowed under the deed. The court noted that if plaintiff had interfered with the first use of the water, defendant still had no right to remove the cover from the spring or make unreasonable use of the water and cause pollution, but should have resorted to his legal remedies. Finding that plaintiff's uses of the spring were only negligible breaches of the covenants in the deed, the court affirmed the trial court's judgment for plaintiff. (Liptak-Fla)
W71-01953

LOUISVILLE AND NASHVILLE RR V MIDDLETON (LIABILITY FOR DAMAGE FROM OVERFLOW OF DRAINAGE WATER CAUSED BY ROAD CONSTRUCTION).
260 Ky 755, 86 SW2d 982-983 (1935).

Descriptors: *Kentucky, *Drainage water, *Flood damage, *Road construction, Railroads, Culverts, Drains, Ditches, Surface drainage, Local governments, Overflow, Water injury, Damages, Obstruction to flow, Roads, Highways, Sediments, Sediment control, Easements, Right-of-way, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff landowner brought action against defendants railroad and county. The county had reconstructed a road and a culvert along the railroad's right-of-way, thereby causing water, sediment and debris to discharge onto plaintiff's adjoining property. Plaintiff contended that the drains and culvert were improperly constructed and maintained, resulting in damage to his property. The jury exonerated the county but found the railroad liable. Reversing a judgment for plaintiff, the court found that defendant railroad had no control over defendant county's method or manner of construction of the road or culvert and held that, even if the railroad did have such control, it could not be liable unless the county had first been found liable. (Liptak-Fla)
W71-01958

CHICAGO, ST L AND N O RR V HICKS (RAILROAD'S LIABILITY FOR FLOOD DAMAGE CAUSED BY ERODED EMBANKMENT).
249 Ky 578, 61 SW2d 37-41 (1933).

Descriptors: *Kentucky, *Embankments, *Washouts, *Damages, Water injury, Railroads,

Construction, Erosion, Cultivated lands, Compensation, Flood damage, Sedimentation, Drains, Ditches, Crop response, Obstruction to flow, Drainage water, Judicial decisions, Legal aspects, Remedies.

Plaintiff landowners brought an action against defendant railroad company to recover for flood damage to their crops. The damage was caused by defendant's embankment washing out and clogging plaintiffs' drainage ditches. Plaintiffs contended that the embankment was improperly constructed, could easily be repaired, and that they were entitled to maintain successive damage actions if the flooding continued. Defendant contended that the embankment was a permanent structure and that plaintiffs could only recover once. Reversing a judgment for plaintiffs, the court held that the lower court should have submitted to the jury the question of whether the embankment was a temporary or a permanent structure. The measure of recovery would differ depending upon the theory chosen. (Liptak-Florida)
W71-01963

DE KALB COUNTY V TENN ELEC POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM OVERFLOW DURING UNPRECEDENTED FLOOD).
67 SW2d 555-561 (Tenn 1933).

Descriptors: *Tennessee, *Historic flood, *Dams, *Flood damage, Floods, Maximum probable flood, Floodgates, Local governments, Bridges, Damages, Water injury, Rivers, Washouts, Overflow, Flood control, Hydroelectric plants, Electric power industry, Judicial decisions, Legal aspects.

Plaintiff county brought action to recover for the destruction of a county bridge. The destruction was allegedly caused by defendant electric power company's negligent operation of its dam and floodgates during a heavy rainstorm and flood. Plaintiff contended that the damage resulted from defendant's release of excess floodwater. Defendant contended that there was no negligent operation of the dam and that the damage was caused by an unprecedented flood which defendant was not required to anticipate. Affirming a judgment for defendant, the court held that defendant had a right to pass flood waters through its gates at the same rate that it flowed into the dam pond. From the uncontradicted evidence, at no time during the flood did the pond level fall below normal. In fact, the water level rose over the top of the dam with all the floodgates open. The only reasonable conclusion was that there had been no negligence on defendant's part. (Liptak-Florida)
W71-01965

DEASON V SOUTHERN RY (DAMAGES FOR OBSTRUCTION TO DRAINAGE).
140 SE 575-581 (SC 1927).

Descriptors: *South Carolina, *Surface drainage, *Obstruction to flow, *Repulsion (Legal aspects), Surface water, Land tenure, Damages, Flow, Railroads, Ditches, Right-of-way, Surface runoff, Channels, Compensation, Reasonable use, Outlets, Drainage, Watercourses (Legal), Legal aspects, Judicial decisions, Ponds, Embankments, Natural flow, Prescriptive rights.

Plaintiff upper landowner sought damages from defendant railroad for preventing the flow of water from a pond on plaintiff's property. Defendant had allegedly, without adequate provision for drainage, erected an embankment and obstructed plaintiff's ditch. In affirming a judgment for plaintiff, the South Carolina Supreme Court held that surface water is a common enemy, and every landowner has the right to protect himself from it. However, one cannot protect himself by backing water onto another's land, thereby creating a nuisance. There was sufficient evidence for the jury to decide that a nuisance was created by the embankment and ditch fill. As to plaintiff's right to the ditch, it was clear it had been in existence longer than the required prescriptive period. On a petition for rehearing one judge dissented, pointing out that the obstruction complained of occurred long before plaintiff acquired title to the property. Any action based on defendant's negligent construction of the embankment could only have been brought by plaintiff's grantor. (Duss-Fla)
W71-02012

NIAGARA FALLS POWER CO V WATER POWER AND CONTROL COMM'N (RIGHTS OF STATE IN GRANTED LANDS).
237 App Div 216, 262 NYS 217-228 (1932).

Descriptors: *New York, *Dams, *Rates, *Diversion structures, Electric powerplants, Hydroelectric plants, Structures, Municipal water, Water utilization, Industrial water, Diversion tunnels, Industrial production, Damsites, Legal aspects, Judicial decisions, Governments, Legislation, Artificial use, Water users, Usufructuary right.

Petitioner power company sought to have respondent water power commission's determination of changes for petitioner's diversion of water reviewed. Petitioner contended that only those rates which were agreed to in its contract with the state were valid. Petitioner further contended that the state did not have title to such rights of diversion for which the state could charge rents because the state had conveyed such rights to it. Respondent contended that since the state had the right to retake previously granted submerged land and the rights connected with them for navigational purposes or the public welfare, it had the right to charge an equitable annual rent for the rights of diversion. Respondent further claimed that the contract between the state and petitioner allowed respondent to increase the rates if petitioner diverted water in excess of the maximum quantity allowed. The court held that while the state could not grant submerged land so as to divest itself of the title held in trust for the public, riparian rights could be severed from the land and conveyed separately. Therefore the court found that the state did not have either title or a proprietary interest in the right to divert water flowing over the granted land for which it could assess charges except as set forth in the terms of the grant. (Quesada-Florida)
W71-02038

SHANDALEE CAMP, INC V ROSENTHAL (OWNERSHIP OF BED NON-NAVIGABLE LAKE).
133 Misc 502, 233 NYS 11-16 (1929).

Descriptors: *New York, *Lakes, *Ownership of beds, *Riparian rights, Easements, Land tenure, Riparian land, Riparian waters, Relative rights, Boundaries (Property), Boundary disputes, Judicial decisions, Legal aspects, Watercourses (Legal).

Plaintiff sought to enjoin defendant from using a portion of a small, non-navigable, freshwater lake which was located within the boundary lines of his property. Defendant sought similar relief. Plaintiff contended that each owned that part of the lake as was described in their deeds as being within their boundary lines. Defendant contended that all who owned property abutting on the lake owned to the center of the lake irrespective of their boundary lines. The court said that the lake was subject to private ownership. However, the rule that adjoining proprietors are presumptively owners of the soil under the water to the center of the lake was not applicable. Plaintiff and defendant owned land not bounded by the lake but by lines within which portions of the lake were included. The principles of private ownership apply to the bed of a small lake as they do to any other land. The owner of a portion of a lake bed has exclusive rights of boating, bathing and fishing in the waters over it. The parties were granted injunctive relief accordingly. (Price-Florida)
W71-02039

STRONG V TRUSTEES OF FREEHOLDERS AND COMMONALTY (INTERPRETATION OF DEED CONVEYING UPLANDS AND LOWLANDS).
133 Misc Rep 165, 231 NYS 664-666 (1928).

Descriptors: *New York, *Contracts, *Boundary disputes, *Boundaries (Property), Right-of-way, Ownership of beds, Beaches, High water mark, Legal aspects, Judicial decisions, Land tenure, Real property, Adjudication procedure.

Plaintiff claimed certain lowlands and brought action to remove a cloud on the title thereto. The court found it necessary to interpret the contract by which plaintiff sold certain uplands. The court found that when plaintiff conveyed such uplands, he also included his title to the submerged land abutting the uplands, any rights of way appurtenant thereto, and all lowlands adjoining said premises. Therefore, the court held that plaintiff had conveyed all his rights, title and interests in the lowlands in question as well as the uplands. A judgment was rendered for defendants. (Price-Florida)
W71-02046

BENNETT V CUPINS (LIABILITY FOR DIVERSION OF SURFACE WATER).
132 Misc 556, 230 NYS 550-553 (1928).

Descriptors: *New York, *Damages, *Surface waters, *Diversion, Drainage, Drainage practices, Diversion structures, Diversion losses, Gravel, Relative rights, Judicial decisions, Legal aspects, Landfills, Grading, Surface runoff.

Plaintiff landowner brought action for damages and sought an injunction against defendant's diversion of surface waters over her property. Defendant's adjoining land, previously servient to plaintiff's so far as regarded surface water drainage, was filled in so as to cause water to flow back onto plaintiff's property. Defendant, relying on case law, contended plaintiff had no remedy. The court distinguished the case relied on by defendant and held that plaintiff did have a cause of action. Plaintiff was entitled to the differences in the rental value caused by defendant's actions, special damages for cleaning by plaintiff, injunctive relief and permanent damages if the nuisance was not abated within a reasonable time. (Price-Florida)
W71-02058

ANTON V STANKE (UPPER PROPRIETOR'S LIABILITY FOR DAMAGE CAUSED BY HIS DIVERSION OF DRAINAGE WATER).
251 NW 153-157 (Iowa 1933).

Descriptors: *Iowa, *Riddance (Legal aspects), *Drainage effects, *Runoff, Discharge (Water), Diversion, Land management, Damages, Remedies, Legal aspects, Judicial decisions, Culverts, Natural flow doctrine, Drainage systems, Relative rights, Highways.

Plaintiff landowner sought to enjoin defendant upper landowner from diverting the drainage runoff from defendant's land into a highway drainage system which flowed by plaintiff's land. Plaintiff contended that defendant was diverting the runoff from its natural course and channeling it through the highway culvert onto plaintiff's land. Plaintiff maintained that defendant's actions resulted in an increase in the amount of water carried by the highway drainage system and that this increase was the cause of the system's overflow which damaged his land. Defendant contended that he was not diverting the groundwater from its natural course. He denied that he made any changes and claimed that upper landowners had a right to unobstructed natural runoff from their land. The Supreme Court of Iowa held that while upper landowners may drain their lands through natural watercourses so as to increase flow over servient lands, this increase cannot be in such an unnatural quantity as would damage other lands. (Quesada-Florida)
W71-02065

HERMAN V DREW (LANDOWNER MAY NOT INTERFERE WITH HIGHWAY DRAINAGE SYSTEM WHICH FOLLOWS THE NATURAL COURSE OF LAND'S DRAINAGE).
249 NW 277-278 (Iowa 1933).

Descriptors: *Iowa, *Surface runoff, *Drainage systems, *Repulsion (Legal aspects), Drainage engineering, Governments, Dams, Ditches, Topography, Paving, Surface waters, Natural flow, Obstruction to flow, Relative rights, Legal aspects, Judicial decisions, Highways, Highway effects, Road construction, Roadbanks.

Plaintiff township trustees sought to enjoin defendant landowner from maintaining a dam across the boundary of his land. The dam prevented runoff from plaintiff's highway from flowing onto defendant's land. This caused the runoff to back up onto the highway. Plaintiff contended that it had maintained the highway and its adjoining drainage systems for over twenty years and further contended that the drainage system followed the natural drainage flow of the land. Therefore, defendant could not obstruct the flow. Defendant contended that such drainage was damaging his land and that it altered the natural flow of the draining water. The Supreme Court of Iowa held that defendant could not interfere with the plaintiff's drainage system since it simply maintained the natural course of the land's drainage. (Quesada-Florida)
W71-02072

SIMONSON V ALDEN TOWNSHIP (LIABILITY FOR DRAINAGE OF SURFACE WATER).
231 NW 921-922 (Minn 1930).

Descriptors: *Minnesota, *Surface drainage, *Reasonable use, *Damages, Surface runoff, Discharge (Water), Watercourses (Legal), Relative rights, Highways, Swamps, Drainage, Land, Land tenure, Cities, Tile drains, Overlying proprietor.
Identifiers: Alden (Minn).

Plaintiff sought an injunction restraining defendants from discharging surface water from the land of defendant upper landowner onto plaintiff's land. Defendants township and upper landowner constructed a tile drain to drain the landowner's swamp so that the water flowed upon plaintiff's lands. Plaintiff admitted that defendant, as upper landowner, had the right to discharge surface water from his land, but contended that construction of the drain from the swamp was unreasonable. The trial court ruled for plaintiff and found that his land would be permanently damaged if the flooding were continued. The Supreme Court of Minnesota stated that an upper proprietor may not unreasonably gather water and cast it upon lower lands in destructive quantities. The question of reasonablenesss is a fact question, and the court held that the evidence justified the trial court's judgment for plaintiff. (Duss-Florida)
W71-02077

THOMPSON V BOARD OF SUPERVISORS (RELIEF FROM ADMINISTRATIVE RULINGS).

206 NW 624-627 (Iowa 1925).

Descriptors: *Iowa, *Drainage districts, *Administrative decisions, *Surface drainage, Administrative agencies, Discharge (Water), Drains, Surface waters, Outlets, Watersheds (Basins), Public benefits, Legislation, Topography, Drainage practices, Channel morphology, Judicial decisions, Legal aspects, Assessments.

Plaintiffs appealed a ruling of defendant board that plaintiffs' property be included in an expansion of a drainage district. Plaintiff contended such inclusion was arbitrary and not justified under the relevant statute since their lands would be benefited by the expansion. From a judgment for plaintiffs reversing its order, defendant appealed. Defendant's main contention was that the trial court lacked jurisdiction since the board's procedure which plaintiffs attacked was legislative, and there was no right of appeal provided in such procedure. Citing case law, the court held that plaintiffs had a right to appeal the order and to try de novo the fact question of whether their lands would be benefited by the proposed improvement. The court also stated that a landowner may freely avail himself of the topography of his land and discharge his surface water wherever gravitation naturally carries it without further concern on his part as to where it goes. The judgment for plaintiffs was affirmed. (Price-Florida)
W71-02078

DAVIS V HAINES (ISLAND OWNER OWNS ACCRETIONS TO THE ISLAND).
349 Ill 622, 182 NE 718-722 (1932).

Descriptors: *Illinois, *Islands, *Accretion (Legal aspects), *Riparian rights, Legal aspects, Judicial decisions, Remedies, Mississippi River, Navigable rivers, Boundaries (Property), Ownership of beds, Riparian waters, Riparian land, Pastures, Low flow, Water level fluctuations, Underwater, Real property, Land tenure.
Identifiers: *Towheads.

Plaintiff sought to quiet title to a towhead in the Mississippi River and to eject defendants therefrom as trespassers. Plaintiff claimed to be the owner, through adverse possession, of an island to which the towhead was connected at low water. Consequently, plaintiff also claimed ownership of the towhead. Defendants countered that they owned the towhead by virtue of quitclaim deeds accompanying their purchase of riparian land east of the river. The Supreme Court of Illinois reversed a lower court decision for defendants, finding that plaintiff had used the towhead for pasturage and cutting of willows and that such acts constituted adverse possession. Further, the court held plaintiff was owner of the towhead through accretion to the island. The rule that a riparian owner owns to midstream applies so that an owner of an island owns to midstream on both sides of the island. (Morris-Florida)
W71-02084

BENNETT V CUPINA (LIABILITY OF LANDOWNER FOR ALTERING GRADE OF LAND).

253 NY 436, 171 NE 698-699 (1930).

Descriptors: *New York, *Surface runoff, *Riddance (Legal aspects), *Grading, Water control, Legal aspects, Judicial decisions, Remedies, Damages, Surface drainage, Slopes, Surface waters, Repulsion (Legal aspects), Watercourse (Legal), Artificial watercourses, Relative rights, Land use, Land management.

Plaintiff sought damages and an injunction to require defendant adjacent landowners' removal of a driveway which caused surface water to flow on plaintiff's land. Plaintiff's land originally was higher than defendants', and surface water flowed onto defendants' property. Predecessors of defendants, however, filled the land in and graded it for erection of a schoolhouse. Defendants contended that since the improvements to their land did not create or alter a definite watercourse, they could not be held liable. The New York Court of Appeals reversed a lower court decision for plaintiff. Any owner may change the natural contour of his land, and as long as he does not create or alter a defined watercourse, any resulting damage does not give rise to a cause of action. (Morris-Florida)
W71-02086

STATE V FORSYTH (TITLE TO LAND CREATED BY RELICTION).
162 NE 661-663 (Ind 1928).

Descriptors: *Indiana, *Accretion (Legal aspects), *Land tenure, *Boundaries (Property), Boundary disputes, Riparian land, Lakes, Water level fluctuations, Riparian rights, Swamps, Lake stages, Nonnavigable waters, United States, Patents, Governments, Surveys, Mapping, Remedies, Judicial decisions, Legal aspects.
Identifiers: Reliction.

Plaintiff state sought to quiet title to certain land created by the recession of a lake. Title to the lake and its bed had been given to the state by the United States. Certain areas bordering closely on the lake were subsequently patented by the state to defendant's predecessor. Plaintiff claimed that its grants were not intended to make the grantees riparian owners. The court found that the grants did make the grantees riparian owners and as such the owners of land created by the recession of the water in the lake. (Barker-Florida)
W71-02087

COLE V PITTSBURGH AND L E RR (LOCATION OF BOUNDARY ON NON-NAVIGABLE STREAM).

162 A 712-717 (Pa 1932).

Descriptors: *Pennsylvania, *Banks, *Boundary disputes, *Boundaries (Property), High water mark, Low water mark, River beds, Ownership of beds, Legal aspects, Judicial decisions, Streambeds, Navigable waters, Railroads, Bridges, Streams, Relative rights, Non-navigable waters, Real property.

Plaintiff riparian landowner brought an action in ejectment against defendant railroad compnay, contending that he was the rightful owner of the land which lay between his riparian land and the low water mark of the river which formed a boundary of his land. Plaintiff contended that since his vendor described the boundary in question as 'along the banks' and that since his vendor owned, at the time of the conveyance, two-thirds of the bed of the river whose banks were to form the boundary, the vendor had intended to convey the land to him all the way out to the low water mark. Defendant, who later acquired the land in question from plaintiff's vendor, contended that the vendor had only conveyed to plaintiff the riparian land to the banks. Defendant contended that the words 'along the banks' meant those boundaries which contain the water at the points of its highest flow. The Supreme Court of Pennsylvania agreed with defendant's interpretation of the terms of the deed and held that the vendor conveyed land only to the banks of the river to plaintiff. The court stated that the presumption that a grantor of land bounded by a stream intends the boundary to extend to the stream is rebuttable, and the vendor's use of 'along the banks' as the description of the boundary was sufficient to rebut the presumed intent. Consequently, defendant was the rightful owner of the land from the banks to the low water mark. (Quesada-Florida)
W71-02089

MASONITE CORP V HILL (POLLUTION VICTIM MUST PROVE CERTAIN POLLUTANT CAUSED INJURY).
154 So 295-299 (Miss 1934).

Descriptors: *Mississippi, *Pollutant identification, *Water pollution effects, *Industrial wastes, Legal aspects, Judicial decisions, Recreation, Damages, Water sports, Water pollution, Fishkill, Water pollution sources, Effluents, Oxygenation, Municipal wastes, Water analysis, Pulp wastes, Chemical wastes, Alcohols, Streams, Downstream.

Defendant manufacturer of masonite emptied a very small percentage of poisonous methyl alcohol, and a few other chemicals, into a creek, causing unidentified chemical changes to take place. Fish died from lack of oxygen. At least two cities and several other industries also dumped effluent into the creek. Plaintiff bather sued defendant manufacturer of masonite for burns allegedly caused by defendant's pollution of the river in which plaintiff

waded. Defendant contended that plaintiff had not sufficiently proved the causal connection between defendant's effluent and plaintiff's injury. The Supreme Court of Mississippi, in reversing a lower court decision for plaintiff, held that the inferences relied on by plaintiff were extended too far. Plaintiff had not sufficiently met the burden of proving that defendant's plant's effluent caused the injury. Chemical analysis of the water would have been possible, and a series of inferences was not a satisfactory substitute. (Morris-Florida)
W71-02092

DAVIS V GARDEN HILLS CORP (PROPER MEASURE OF DAMAGES FOR POLLUTION OF STREAM).
148 SE 861-864 (Ga 1929).

Descriptors: *Georgia, *Water pollution, *Damages, *Profit, Sewage, Streams, Legal aspects, Judicial decisions, Impaired water quality, Local governments, Water pollution effects, Water pollution sources, Riparian rights, Downstream, Pollutants, Milk, Dairy industry, Cattle, Adjudication procedure, Land tenure.

Plaintiff dairy farmer sued for actual and punitive damages, alleging that defendant real estate developer had caused pollution of a stream and thereby reduced the profits of plaintiff's dairy business. Plaintiff alleged that he had spent money for cows and equipment for the leased property and that he had been operating at a profit before defendant built and sold houses on its property, draining sewage into a stream which flowed onto plaintiff's property and from which plaintiff's cows obtained water. The City of Atlanta health department told plaintiff to quit using the polluted water, thus forcing plaintiff to spend additional money to obtain water and reducing his profits. Defendant contended that plaintiff did not allege a proper measure of damages. The Georgia Court of Appeals held that since plaintiff was a tenant, the damage should be the difference in the value of the tenancy before and after the pollution, not the dimunition in profits. (Morris-Florida)
W71-02093

SOZANSKA V TOWN OF STRATFORD (DRAINAGE OF SURFACE WATER DISCHARGED FROM PUBLIC STREETS).
153 A 164-166 (Conn 1931).

Descriptors: *Connecticut, *Obstruction to flow, *Riparian rights, *Natural streams, Streams, Drainage, Highways, Relative rights, Public rights, Cities, Local governments, Surface waters, Diversion, Judicial decisions, Legal aspects, Streamflow, Grading, Surface drainage, Land, Surface runoff, Tile drainage, Ditches.
Identifiers: Stratford (Conn).

Plaintiff landowner's property contained a tile drain once used to channel the flow of a stream fed by a stream located on the other side of a public highway from plaintiff's land. A change in grade of the highway altered the course of the stream so that it no longer crossed plaintiff's land. For years since the change in course, the drain had been obstructed by accumulated soil. Defendant town entered plaintiff's land without his permission and sought to open the drain located in plaintiff's front yard. Plaintiff sought damages for trespass and an injunction. Defendant contended that the drain was the channel of a natural stream and that defendant, as an upstream riparian owner, was entitled to its unobstructed flow. In affirming the trial court's judgment for plaintiff, the court found that the alleged natural watercourse had ceased to exist, and thus defendant was no longer a riparian owner. The court further held that Connecticut statutes prohibited discharge of surface waters from public streets through or under the yard of any dwelling house. (Dye-Florida)
W71-02094

MARBA SEA BAY CORP V CLINTON STREET REALTY CORP (BOUNDARY DISPUTE RELATING TO HIGH WATER MARK).

272 NY 292, 5 NE2d 824-829 (1936).

Descriptors: *New York, *High water mark, *Seashores, *Boundary disputes, Legal aspects, Ownership of beds, Banks, Tidal waters, Low water mark, Judicial decisions, Public lands, Governments, Oceans, Land tenure.

Plaintiff corporation brought an action in partition against defendant realty corporation which had taken title from the state. Plaintiff contended that it had title through a colonial grant. Plaintiff argued that it owned all the waterfront property, including the foreshore, and was not limited by the high water mark. Defendant contended that such colonial grant was void because it was made to private persons for neither commercial nor governmental purposes and was thus against public policy. The New York Court of Appeals held for defendant. The colonial title was void as against public policy. It conveyed public lands for non-public purposes. Moreover, the court found that the deed, describing a boundary as 'bounded southerly by the Atlantic Ocean', conveyed title no further than the high water mark. This excluded the foreshore. (Quesada-Florida)
W71-02097

MONTANA POWER CO V ROCHESTER (OWNERSHIP OF LAND BETWEEN HIGH AND LOW WATER MARKS).
127 F2d 189-193 (9th Cir 1942).

Descriptors: *Montana, *Ownership of beds, *Patents, *Easements, Navigable waters, High water mark, Low water mark, Boundaries (Property), Boundary disputes, Dams, Reservoirs, Outlets, Lakes, Flooding, Relative rights, Right-of-way, Federal government, Legislation, Judicial decisions, Legal aspects, United States.

Plaintiff owned an island in a lake. The island was connected to the shore by a bar. The owner of the lot where the bar met the shore had granted plaintiff an easement over his lot and the bar. Defendant power company had, with the permission of the Federal Power Commission, flooded the bar. Plaintiff sought damages as such flooding made her island inaccessible except by boat. Plaintiff contended that the owner of the shore lot owned to the low water mark and had title to the bar and that she was entitled to damages for the destruction of her easement. Defendant contended that the shore lot owner held title only to the high water mark, that the United States held title to the bar as part of the lake bed, and that the lot owner had no right to grant the easement now claimed by plaintiff. The court held that the general rule is that United States' patents to lands bordering on navigable waters convey title only to the high water mark. The area between the high and low water marks should be in the sovereign. Consequently, plaintiff's easement was improperly granted, and the trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-02098

RICHARD T GREEN CO V CITY OF CHELSEA (TAXATION OF REAL PROPERTY ON NAVIGABLE WATERS).
149 F2d 927-932 (1st Cir 1945).

Descriptors: *Massachusetts, *United States, *Real property, *Taxes, Judicial decisions, Legal aspects, Legislation, Navigable waters, Federal government, Assessments, Low water mark, Cities, Local governments, Docks.

The United States took certain waterfront land under its power of eminent domain. The questions involved in the instant case were whether certain tax liens asserted by plaintiff city against the land were valid, whether a marine railway which was located on the land was real or personal property, and whether the entire railway, part of which extended below the low water mark, was taxable as realty. The court held that the fact that the license for construction of the railway extended only to the low water mark was not conclusive in construing the machinery to be personal property even though Massachusetts law indicated that private property in lands adjacent to navigable waters extends only to the low water mark. Although such license did not grant title to the real estate, there was no reason why the railway would not be assessed as real estate for purposes of taxation. The circuit court affirmed the district court's determination that under Massachusetts law, such a structure attached to the land was real estate and thus subject to taxation. (Barnett-Florida)
W71-02100

POINSETT LUMBER AND MFR CO V UNITED STATES (COMPENSATION FOR PHYSICAL INVASION OF PRIVATE PROPERTY BY GOVERNMENT PROJECTS).
91 Ct Cl 264-268 (1940).

Descriptors: *United States, *Compensation, *Levees, Flood control, *Arkansas, Legislation, Lumbering, Judicial decisions, Legal aspects, Missouri, Federal government, Drainage districts, Drainage engineering, Construction, Flood protection, Dams, Diversion, Alteration of flow, Headwaters, Tributaries, Backwater, Beneficial use, Eminent domain, Flood damage.

Plaintiff lumber company owned timber lands situated along the banks of the St. Francis River in Arkansas. Defendant, pursuant to statute, entered upon the land for the purpose of establishing a new levee line in accordance with a plan of levee construction on the tributaries of that river. Plaintiff alleged that such planned construction would force the waters of the river over its lands resulting in the destruction of the standing timber thereon. The Court of Claims held that nothing had been done by defendant's engineer which would directly cause the diversion of water over the property in question. The construction work was found not to affect plaintiff's use or occupation of the lands. The court stated that in order to constitute a taking such as will entitle an owner to maintain a suit against the government for compensation, it must definitely appear that there has been an actual physical invasion or encroachment upon private property, or else such a direct physical destruction as to permanently dispossess the owner. (Barnett-Florida)
W71-02114

WATER SUPPLY AND WASTE WATER DISTRICTS IN SUBURBIA,
Myron K. Nelson, and R. L. Chandler.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA2, p 593-604, April 1970. 5 fig, 1 tab.

Descriptors: *Water district, *Urbanization, *Management, *Water supply, Sewage treatment, Sewers, Water treatment, Sanitary engineering, Institutions, Administration.
Identifiers: *Suburbia, *Waste water treatment districts.

Formation of water and sewer districts in a highly urbanized area composed of fourteen separate cities are described. The water districts have encouraged the orderly development of this rapidly expanding area in the following ways: (1) The ability of the district to finance large major improvement projects when such improvements are needed; (2) the main extension policies of the District which assure recovery of the original investment or deposit by the developer through refunds after customers are connected to the mains; and (3) the practice of constantly studying and reviewing the projected needs of the District. The waste water districts use the following methods: (1) The

ability of the Districts to meet varying conditions of development; (2) the ability of the Districts to plan and finance on a major watershed basis; (3) one central administration for all Districts permits an economical operation as well as uniform rules, regulations, and other requirements; and (4) the ability of the Districts to finance enlargements of collection and treatment facilities by a resolution of the governing body without additional elections or petitions. (Davis-Chicago)
W71-02117

LOUISIANA DELTA CATTLE CO V UNITED STATES (LIABILITY FOR PROJECTED DAMAGES FROM PROPOSED IMPROVEMENT).

93 Ct Cl 662-666 (1941).

Descriptors: *Louisiana, *Flood control, *United States, *Compensation, Flood protection, Mississippi River, Judicial decisions, Legal aspects, Levees, Drainage, Precipitation excess, Federal government, Outlets, River flow, Eminent domain, Public rights, Damages, Remedies, Legislation, Condemnation, Flood damage, Water injury.

Plaintiff owned lands adjacent to the Mississippi River which were protected against flood or water submergence by public levees along the banks of the river. As a result, plaintiff's lands were arable, valuable and subject to easy drainage of intense rainfall. Defendant, pursuant to a plan under the Flood Control Act, selected a new set-back or levee line which plaintiff alleged would cause all flood protection to be withdrawn, allowing the river to overflow and damage its land. Plaintiff sought to recover the value of the land as a result of these acts. The court held that plaintiff was not entitled to recover where there was no allegation in its petition of a past or consummated innundation or damage and where the damage alleged was prospective upon the abandonment or removal of the previous levees. The court held that the mere fact that the value of the property was injured or affected by some act which the government proposed to do in the future did not establish a 'taking' within the meaning of the fifth amendment. (Barnett-Florida)
W71-02118

ANDERSON V REAMES (RIPARIAN RIGHTS OF LAKE PROPERTY OWNER)
161 SW2d 957-961 (Ark 1942).

Descriptors: *Arkansas, *Riparian land, *Riparian rights, *Public rights, Remedies, Reasonable use, Banks, High water mark, Low water mark, Legal aspects, Judicial decisions, Docks, Piers, Boats, Recreation, Boat-launching ramps, relative rights, Land use, Lakes, Lake shores.

Plaintiff fish camp operators sought an injunction to force defendant riparian lessees to allow plaintiffs' customers onto certain riparian land. Plaintiffs contended that by reason of the fact that the lake was navigable, they, as members of the public, had the right to operate a commercial boat dock and use the shore in the conduct of their business. Defendants contended that the right to operate a dock and use the banks was a riparian right belonging to the owner of the riparian land, which was properly leased to them. While holding that plaintiffs' structures had to be removed from defendants' lands, the Supreme Court of Arkansas also delineated the following rights of a riparian landowner and of a member of the public: (1) the riparian owner has use and control of his land to the high water mark; (2) the only right that a riparian owner has over the rights of the general public is the right to free ingress and egress to his property along its edge; (3) the riparian rights of an owner include access to the water, the right to build a pier to the line of navigability, and the right to accretion and reasonable use of the water; and (4) no private person can claim an exclusive right to fish in navigable water. (Quesada-Florida)
W71-02119

FARRAR V SHUSS (RIGHTS OF SERVIENT LANDOWNER TO PREVENT FLOW OF SURFACE WATER ONTO HIS PROPERTY).
282 SW 512-515 (Mo 1926).

Descriptors: *Missouri, *Impounded waters, *Surface waters, *Repulsion (Legal aspects), Diversion, Flooding, Floodwater, Drainage, Discharge (Water), Impoundments, Reservoirs, Dams, Overflow, Surface runoff, Backwater, Diversion structures, Easements, Judicial decisions, Legal aspects, Flood damage, Damages.

Plaintiff landowner sought damages for injury to his property allegedly caused by the collection of surface water behind defendant's reservoir and by the negligent maintenance of said reservoir which caused the water to be released with force on plaintiff's land. Defendant demurred to plaintiff's allegations. The court stated that in order to recover for the discharge of surface water upon the land of another, some negligence must be shown. The court found that defendant was negligent in the construction or maintenance of the reservoir. Defendant had no right to dam up the water and throw it back with destructive force onto plaintiff's land. The owner of a servient estate may erect obstructions to prevent surface water from coming onto his land and in this manner throw water back on the dominant estate without incurring liability. The court held, however, that defendant had collected the water which caused plaintiff's injury and did not act simply to prevent such water from coming onto his property. The trial court's judgment for defendant was reversed. (Price-Florida)
W71-02124

KILGO V COOK (OWNERSHIP OF BEDS OF NON-NAVIGABLE STREAMS).
295 SW 355-357 (Ark 1927).

Descriptors: *Arkansas, *Boundary disputes, *Ownership of beds, *Meanders, Streams, Rivers, Real property, Boundaries (Property), Banks, Beds, Legal aspects, Judicial decisions, Shores, Navigable waters, Navigable rivers, Running water, River beds, Riparian rights, Riparian land, Nonnavigable waters, Recreation, Lakes, Streambeds.

Properties of plaintiff and defendant were originally part of a single grant. The government survey of the original grant took no notice of a nonnavigable stream which ran through the property. The description in plaintiff's deed extended his property to the east bank of the stream, including the streambed. Defendant's property, across the stream, was also bounded by the east bank. Plaintiff sought to quiet title in the streambed and to restrain defendant from trespassing thereon. Defendant claimed to be a riparian owner, and as such the owner to the thread of the stream. The Supreme Court of Arkansas reversed a judgment for defendant. Although owners of land bordering a meandered non-navigable stream take title to the center of the stream, where property was surveyed as land and the streams therein were not meandered, the owner of the land may dispose of it in the manner of his choosing, even to the exclusion of some grantees' riparian ownership. In the instant case the stream in question was not meandered. Since defendant took title with notice of the prior grant of the streambed to plaintiff, he could not later claim to be a riparian owner. (Dye-Florida)
W71-02125

DUGAN V LONG (LIABILITY FOR DIVERSION OF NATURAL FLOW OF SURFACE WATER).
234 Ky 511, 28 SW2d 765-767 (1930).

Descriptors: *Kentucky, *Surface waters, *Natural flow, *Landfills, Landscaping, Ponding, Rain, Flooding, Canals, Culverts, Judicial decisions, Legal aspects, Construction, Grading, Obstruction to flow, Pipes, Septic tanks, Overlying proprietor, Easements, Impoundments, Drainage, Adjudication procedure, Damages, Flood damage.

Plaintiff owned land adjacent to defendant. Defendant's land was situated lower than plaintiff's, and surface water in its natural course flowed from plaintiff's land on and across defendant's property. Defendant filled in and raised the grade of her lot, thereby obstructing the natural flow of surface water. This obstruction caused the water to accumulate and flood plaintiff's lot after every unusually heavy rainfall. Plaintiff sought to recover damages which resulted from such flooding. The court stated that a lower estate is subject to an easement of receiving the natural flow of surface water from an upper estate and that an owner of a lower estate has no right to create obstructions which interfere with such natural flow. However, the court ruled that since defendant's structure was permanent, there could be but one recovery for past, present, prospective or contingent damages. The action for such damages had to be brought within the applicable statute of limitations. Plaintiff failed to so bring his action and was therefore barred from recovery. (Barnett-Florida)
W71-02126

CITY OF COVINGTON V STATE TAX COMM'N (ASSESSMENT OF SUBMERGED LAND FOR TAXING PURPOSES).
231 Ky 606, 21 SW2d 1010-1018 (1929).

Descriptors: *Kentucky, *Boundaries (Property), *Taxes, *Beds under water, Bridges, Low water mark, Cities, Thalweg, Boundary disputes, Assessments, Judicial decisions, Legal aspects, State governments, Administrative agencies, Administration, Ohio, Tidal waters, Navigable waters, Banks, Riparian rights, Riparian land, Ownership of beds.
Identifiers: Covington (Kentucky).

Plaintiffs brought suit to enforce assessment of defendant city's land to collect taxes covering the cost of building bridges that serviced defendant municipal corporation. A dispute arose as to how much of defendant's land bordering on the Ohio River was in fact assessable for tax purposes. Plaintiff alleged that the corporate limits extended to the thread of the stream bounding defendant city. Defendant, relying on its charter and grant, alleged ownership in assessable lands extended solely to the low water mark of the river. The court stated that where deeds call for boundary line with physical dimensions, such as a road, street, stream or watercourse, individuals and municipal corporations own to the center of the physical line or thread of the stream, unless such boundary is a stream in which the tide ebbs and flows. There being no ebb or flow in the instant case, the court held that the assessable property extended to the center of the stream. (Barnett-Florida)
W71-02127

KERBY V PRAIRIE PIPE LINE CO (INJURY TO CATTLE CAUSED BY OIL POLLUTION OF WATER).

11 SW2d 758-759 (Mo 1928).

Descriptors: *Missouri, *Pipelines, *Oil, *Water pollution, Pollution sources, Cattle, Judicial decision, Legal aspects, Damages, Remedies, Surface waters, Streams, Dams, Water pollution effects, Water pollution sources, Adjudication procedure, Oil industry, Pollution.

Plaintiff owned land through which a stream flowed. Defendant corporation engaged in the transportation of crude petroleum. At a point above plaintiff's lands where defendant's pipes crossed the stream, the pipes burst, causing the oil to flow into the stream and subsequently onto plaintiff's lands. Defendant attempted to remove the oil from the stream by burning it and burying the excess slag in the banks of the stream. Plaintiff's cattle, grazing and watering in a portion of the stream, were injured as a result of drinking the polluted water. Plaintiff alleged that defendant's negligent maintenance of the pipeline had permitted the pipe to break. The court held that defen-

dant's demurrer should be sustained in that there was no evidence of negligence on the part of the defendant. (Barnett-Florida)
W71-02128

FORDSON COAL CO V PLEASNICK (LIABILITY FOR DAMAGE FROM OVERFLOW CAUSED BY EXTRAORDINARY RAINS).
215 Ky 794, 287 SW 11-12 (1926).

Descriptors: *Historic flood, *Kentucky, *Floods, *Flood damage, Flood control, Maximum probable flood, Design flow, Discharge (Water), Flood protection, Floodwater, Overflow, Rain, Rain water, River flow, Streamflow, Streams, Storm runoff, Bridges, Bridge construction, Legal aspects, Judicial decisions, Excess precipitation.

Plaintiff purchased a tract of land immediately above a railroad bridge which was erected across a stream. Defendant coal company then constructed two bridges across the stream immediately below the railroad bridge. Subsequent to such construction, a flood occurred which damaged plaintiff's property. Plaintiff brought an action for damages upon the theory that defendant had negligently constructed its bridge across the stream, thereby obstructing the natural flow of the water from ordinary rainfall and causing the stream to overflow. Witnesses testified at the trail that the rains and flood were unusual and extraordinary. The Kentucky Court of Appeals reversed the trial court's judgment for plaintiff. The court held that one constructing a bridge over a stream is not liable for damages from overflows caused by such extraordinary rains or floods as could not have been anticipated. (Powell-Florida)
W71-02129

CHESAPEAKE AND O RY V RICE (LIABILITY FOR DAMAGE TO LAND FROM DRAIN OBSTRUCTION).
221 Ky 695, 299 SW 565 (1927).

Descriptors: *Kentucky, *Alteration of flow, *Obstruction to flow, *Diversion, Water rights, Railroads, Drains, Legal aspects, Judicial decisions, Ditches, Surface water, Drainage water, Surface drainage, Right-of-way, Watercourses (Legal), Natural flow, Diversion structures, Adjudication procedure.

Plaintiff owned property that abutted defendant railroad's right-of-way. Defendant constructed a ditch along its right-of-way and diverted water into the ditch which formerly flowed in an opposite direction. Plaintiff brought an action for damages which resulted from such changes in the natural flow. Plaintiff alleged that the ditch was not of sufficient size to allow proper drainage and that in times of ordinary rainfall water flowed and stood upon plaintiff's property. Plaintiff further alleged that defendant was negligent in permitting the ditch to become obstructed. Witnesses at the trial failed to give any estimate of the value of the property destroyed or any estimate of the diminution in the value of the use of the property caused by the overflow. The Court of Appeals of Kentucky reversed the lower court's judgment for plaintiff. The court held that the verdict against defendant railroad was excessive because of the vagueness and uncertainty of the evidence supporting it. (Powell-Florida)
W71-02130

WINCHESTER WATER WORKS CO V HOLLIDAY (WATER COMPANY'S LIABILITY FOR DAMAGES RESULTING FROM BUILDING OF A FLASHBOARD DAM).
241 Ky 762, 45 SW2d 9-11 (1932).

Descriptors: *Kentucky, *Reservoirs, *Dam failure, *Flooding, Public utilities, Dams, Flood control, Damages, Remedies, Crops, Farms, Judicial decisions, Legal aspects, Lakes, Streams, Surface waters, Spillways, Surplus water, Impounded waters, Construction, Natural flow, Rainfall.

Plaintiff landowners sued defendant water company for damages from a flood caused by the breaking of a flash dam built and operated by defendant. Defendant had built two artificial lakes as reservoirs. One of these lakes was created by building a dam across an existing creek. To increase the impoundment of waters behind the dam in the dry season, defendant built a temporary flashboard dam across the top of the permanent dam, thereby increasing the dam's height by fifteen inches. Plaintiffs alleged that defendant's negligent construction of the flashboard dam was the cause of the flooding to their property. Defendant contended that the dam was not negligently built, but was intended to wash-out at times of heavy rainfall. The court found no evidence of negligence but held that defendant, as an upper proprietor had no right to impound waters and then to release them suddenly upon the lands of lower proprietors. Defendant could not, without liability construct a device that would give way automatically during a flood. (Barnett-Fla)
W71-02131

BOARD OF TRUSTEES OF TOWN OF AUBURN V CHYLE (CITY NOT LIABLE FOR FLOODING CAUSED BY STREET DRAINAGE).
256 Ky 283, 75 SW2d 1039-1041 (1934).

Descriptors: *Kentucky, *Surface runoff, *Riddance (Legal aspects), *Road construction, Roads, Drains, Sewers, Water injury, Flooding, Cities, Local governments, Surface waters, Natural flow, Rainfall, Rain water, Runoff, Grading, Drainage water, Judicial decisions, Legal aspects, Damages.
Identifiers: Auburn (Kentucky).

Plaintiff landowner brought action to recover damages caused by defendant city's alleged negligence in repairing streets and drains. As a result of the negligence, plaintiff's property was flooded when it rained. Plaintiff contended that defendant had a duty to maintain its streets and drains so as not to collect and discharge surface water onto landowners' property. Defendant contended that plaintiff's property had always flooded when it rained and that the street repairs did not change the natural flow of surface water. Reversing a judgment for plaintiff, the court held that plaintiff had failed to show that defendant's street repairs had changed natural conditions and caused flooding. The court noted that landowners are subject to the natural flow and drainage of surface water and could not complain unless the quantity or direction of flow had been changed by another. (Liptak-Fla)
W71-02132

BABER V GRIGGS (LIABILITY FOR DIVERTING SURFACE WATER FROM ROADWAY ONTO ADJACENT LAND).

252 Ky 816, 68 SW2d 419-421 (1934).

Descriptors: *Kentucky, *Roadbanks, *Surface runoff, *Repulsion (Legal aspects), Roads, Erosion control, Grading, Highways, Road construction, Slopes, Road design, Access routes, Diversion, Diversion structures, Drainage water, Drainage effects, Surface waters, Judicial decisions, Washouts, Adjudication procedure.

Plaintiff and defendant owned adjoining farms. Defendant's only means of ingress and egress was a small road through plaintiff's property to the public highway. Plaintiff brought a damage action claiming that defendant had built elevations in the road and thus diverted drainage water from the road onto plaintiff's land. Defendant contended that he had only repaired the elevations which were built 15 years before along with the road, that without them the road would wash out and be useless, and that plaintiff was precluded from complaining of the elevations because of their existence and repeated repair for so many years. The court affirmed a judgment for defendant, finding no error in the lower court's rulings or jury instructions. (Liptak-Fla)
W71-02133

CHAPTER VII: POLITICAL AND INSTITUTIONAL ASPECTS OF THE EVALUATION OF WATER RESOURCE PROGRAMS.
For primary bibliographic entry see Field 06B.
W71-02137

KELLEY ISLAND LIME AND TRANSPORT CO V CITY OF CLEVELAND (LIABILITY FOR OBSTRUCTION OF NAVIGABLE WATERCOURSES).
47 F Supp 533-545 (ND Ohio 1942).

Descriptors: *Ohio, *Admiralty, *Navigable waters, *Remedies, Rivers, Construction, Bridges, Accidents, Contracts, Mechanical equipment, Obstruction to flow, Navigable rivers, Legislation, Damages, Judicial decisions, Legal aspects, Navigation, Ships, Highways, Cities.
Identifiers: *Obstruction to navigation.

Libel was brought against the City of Cleveland for negligently obstructing a navigable waterway within its city limits. Libelant ship was lawfully navigating a river when it struck a hidden obstruction in the river and sank. Libelant alleged that libelee city was charged by statute to keep the highways free of obstruction and that since a navigable river was a public highway, libelee should be liable. The court rejected this claim and found that a navigable river was not a public highway within the meaning of the statute. However, the court held that libelee could be held liable because, while engaged in its statutory function of caring for bridges, aqueducts, and viaducts, it caused an obstruction to be placed in the river and left it there without properly marking it. The mere placing of an obstruction in a navigable stream without warning in and of itself constituted negligence and gave rise to liability for the resulting injury to libelant. (Barnett-Fla)
W71-02142

METROPOLITAN PLANNING AND IMPLEMENTATION,
Metropolitan Council of the Twin Cities, Minn.
Robert C. Einsweiler.
Proceedings, American Society of Civil Engineers, Journal of the Urban Planning and Development Division, Vol 96, No UP2, p 113-121, October 1970. 2 fig.

Descriptors: *Planning, *Governments, City planning, Land use, Administration, Inter-agency cooperation.
Identifiers: *Metropolitan planning, Public policy, *Implementation, Policy, Professional practice.

Governmental decision-making in metropolitan areas is gravitating toward more comprehensive, area-wide, policy-oriented organizations and creating new roles for engineers. The new Metropolitan Council has its roots in the Minneapolis-Saint Paul Sanitary District created in 1933. The Council represents an evolution in geographic scope from two central cities to seven counties; and in method of representation from local elected officials to metropolitan district representatives. In authority, it combines regional planning with operating subordinate boards, the successors to independent metropolitan authorities. In the process, the role of the engineer has changed. He now participates as a member of a multidiscipline team in recommending regional development policy to the Metropolitan Council and continues more typical engineering roles with subordinate boards in the design, construction and operation of metropolitan public works. Similar changes, though less advanced are occuring across the nation. Engineers should see this as an opportunity to improve the democratic process. The alternative of technocracy is not a professionally responsible approach. (Davis-Chicago)
W71-02143

BASIC CONTEMPORARY URBAN PROBLEMS,
Illinois State Div. of Highways, Springfield.
For primary bibliographic entry see Field 06B.
W71-02144

STORM WATER FOR FUN AND PROFIT,
Chicago Univ., Ill. Center for Urban Studies.
For primary bibliographic entry see Field 06B.
W71-02150

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY OF LICENSEE FOR MAINTENANCE OF FLASHBOARDS ON FEDERAL DAM).

126 Misc 126, 212 NYS 630-638 (1925).

Descriptors: *New York, *Dams, *Overflow, *Flood damage, Leases, Spillway crests, Spillway gates, Spillways, Federal government, Judicial decisions, Legal aspects, Dam construction, Dam design, Public benefit, Hydraulic structures, Hydroelectric plants, Navigation, Riparian rights, Water rights, Impoundments, Backwater, Relative rights, Competing uses.

Defendant motor company, pursuant to a government lease, constructed a hydraulic powerplant on lands adjoining a federal dam and installed flashboards on the main spillway of the dam. Consequently, the elevation of water on the land of plaintiff manufacturing company was raised, causing damage to its property and water power. Plaintiff brought an action seeking removal by defendant of the flashboards installed on the dam. Defendant contended that it was acting as an agency of the federal government which was authorized to maintain and erect flashboards for the benefit of interstate commerce. Plaintiff contended that defendant erected the flashboards to aid operation of its powerplant. The court, in ordering removal of the flashboards, stated that the federal government, in the interest of navigation, could lawfully maintain flashboards on the dam spillway. However, where maintenance of flashboards by defendant licensee for the purpose of improving its water power plant operation was the cause of damage, maintenance thereof was without justification. (Powell-Florida)
W71-02159

CORBY V RAMSDELL (OBSTRUCTION TO NAVIGATION AS PUBLIC NUISANCE).
48 F2d 701-704 (2d Cir 1931).

Descriptors: *New York, *Admiralty, *Ships, *Navigation, Rocks, Charts, Harbors, Shoals, Warning systems, Navigable waters, Ownership of beds, Damages, Rock foundations, Boats, Shallow water, Channels, Judicial decisions, Legal aspects, Adjudication procedure, Accidents.

Libelant yacht owner brought libel against respondent owner of submerged land for damages to libelant's yacht which resulted from striking submerged rocks on respondent's land. Respondent's predecessor in interest had begun construction of a pier on the tidelands; it was never completed and fell into disrepair, with foundation rocks lying just beneath the surface of the water. Charts indicated the pier and gave water depth from 3 to 8 ft. Libelant's yacht, drawing 4 ft., was run at 26 m.p.h. over the rocks by an unfamiliar master who did not examine the chart. There was a passable channel available. Libelant asserted that the pier was a public nuisance of which respondent had notice. Respondent contended that it was not liable since there was no request to abate the nuisance. The court stated that the rule which requires a request to abate applies only to private nuisance, and noted that no one could maintain a public nuisance with notice without incurring liability. The yacht's passage outside the channel in itself was determined not to relieve respondent from liability. However, the court held that libelant was contributorily negligent, and apportioned the damages awarded. (Hart-Florida)
W71-02160

BURKE V SOUTHERN BELL TEL AND TEL CO (LIABILITY OF UTILITY COMPANY FOR OBSTRUCTION OF RIVER).
55 F2d 732-733 (SD Ala 1932).

Descriptors: *Alabama, *Public utilities, *Boats, *Navigation, Utilities, Bridges, Transportation, Water rights, Judicial decisions, Legal aspects, Rivers, Damages, Remedies, Regulation, Federal government, Floods.

Defendant telephone company stretched wires across a river near a bridge. The wires' location permitted clearance of river steamers' smokestacks even in floodwaters. Subsequently defendant, without federal permission, placed additional wires across the river two feet lower than those originally placed. Plaintiff boat captain knew of the existence and location of the original wires, having passed under those wires during floodwater. In attempting to pass under the bridge during subsequent flood conditions, the boat suffered damages when the additional wires caught plaintiff's boat's smokestacks. Plaintiff brought an action for damages, alleging that defendant was negligent in placing the additional wires. Defendant contended that plaintiff was negligent because of his knowledge of the wires and his failure to ascertain the clearance between the water and the wires. The court held that since all wires were strung without authorization, they constitued an obstruction of the stream for which defendant was liable. The court stated that plaintiff, not knowing that additional wires which were lower than original wires had been placed across the river, was not negligent in attempting to pass under the bridge during floodwaters. (Powell-Florida)
W71-02161

AKTIESELSKABET DAMPSKIB GANSFJORD V UNITED STATES (SHIP MAY BE SUBJECT TO LIBEL IN COURT OF LAW FOR DAMAGE TO LAND OBJECT).
32 F2d 236-237 (5th Cir 1929).

Descriptors: *Louisiana, *Jetties, *Ships, *Admiralty, Rivers and Harbors Act, Legal aspects, Judicial decisions, Remedies, Damages, Legislation, Federal government, Coastal structures, Sea walls, Mississippi River, Navigable waters, Land, Jurisdiction.
Identifiers: *Libel.

Plaintiff federal government brought action in libel against the claimants of the steamship Gansfjord for damage allegedly caused when the ship ran into a jetty in the Mississippi River. Defendant contended that since a court of admiralty would not recognize the suit, because a jetty is considered land and there would be no right of action, the federal district court should not have entertained it. The Court of Appeals, Fifth Circuit, in affirming a judgment for plaintiff, held that the Rivers and Harbors Act of 1899 authorized an action for impairing the usefulness of jetties. The mere fact that a court of admiralty will not recognize the suit because a land object was involved does not mean a court of law cannot handle it. Law courts also recognize remedies against an object, such as the ship, which is used to violate a law. The ship was liable for the damage. (Morris-Florida)
W71-02162

UNITED STATES V NORFOLK-BERKLEY BRIDGE CORP (LIABILITY OF BRIDGE COMPANY FOR OBSTRUCTING NAVIGATION).

29 F2d 115-132 (ED Va 1928).

Descriptors: *Virginia, *Bridge construction, *Rivers and Harbors Act, *Admiralty, Legal aspects, Judicial decisions, Damages, Federal government, Navigable waters, Transportation, Ships, Boats, Bridge design, Disasters, Bridges, Legislation, Navigation, Rivers, Permits, Administrative agencies, Adjudication procedure, Relative rights.

The federal government and a bridge company filed in admiralty to recover from a limitation of liability fund established by a towing company whose tugboats were pulling the government's ships in two separate collisions between the ships and a bridge. The government and the towing company alleged that the bridge company was negligent and that it violated the Rivers and Harbors Act's provisions against obstructing navigation by allowing quadrant gears to overhang a passageway between the bridge's fenders. The federal district court agreed, but also found that the towing company had been negligent because it had warning of the dangerous condition but proceeded to navigate the ships in a manner which led to collisions between the overhanging quadrant gears and the ships' superstructures. The court held that the bridge company could recover from the remainder of the towing company's liability fund despite its negligence since admiralty, in contrast to common law, allows awards based on comparative negligence. The court found that Congress intended such recoveries, even though the bridge company would not have a right of action at common law, in setting up the limitation of liability fund requirements. (Morris-Florida)
W71-02163

THE GANSFJORD (SHIP SUBJECT TO LIBEL FOR DAMAGING JETTY).
25 F2d 736-738 (ED La 1928).

Descriptors: *Louisiana, *Rivers and Harbors Act, *Jetties, *Ships, Disasters, Legal aspects, Judicial decisions, Remedies, Damages, Legislation, Federal government, Navigation, Coastal structures, Sea walls, Admiralty, Mississippi River, Fog, Navigable waters, Channels, Land, Federal jurisdiction, Jurisdiction.

Libellant federal government filed an action in libel against a ship which crashed into a jetty in the Mississippi River. The government claimed the ship violated the Rivers and Harbors Act which prohibited impairment of jetties. Claimant attacked the constitutionality of the Act, which provided a libel remedy in the district court, as an encroachment of admiralty juridiction and also claimed that negligence had not been proven. The district court overruled exceptions and granted a decree for libellant, holding that the Constitution does not bar Congress from distributing admiralty jurisdiction. The court stated that Congress wanted to provide protection for shore properties by admiralty liens since admiralty would not recognize actions involving shore properties and the law remedy was inadequate. The court also held the ship was operated in gross negligence since it was proceeding at full speed in a dense fog in a narrow channel, but added that negligence was not necessary under the language of the Rivers and Harbors Act. (Morris-Florida)
W71-02164

THE GEORGIE (LIABILITY FOR DAMAGE FROM INJURY TO SUBMARINE COMMUNICATIONS CABLE).
14 F2d 98-100 (9th Cir 1926).

Descriptors: *Admiralty, *Anchors, *Electric cables, *Damages, Ships, Communication, Legislation, Judicias, Legal aspects, Navigation, Regulation, Adjudication procedure, Remedies.

Plaintiff United States brought libel against defendant vessel for injury to plaintiff's submarine communications cable. Defendant anchored and snagged the cable, thereby causing the injury. Plaintiff had given no notice of the cable's location, and it was not plotted on marine charts. Plaintiff contended that defendant had imputed knowledge of the cable location and that defendant was negligent per se by anchoring in contravention of area anchoring regulations. The court held that defendant did not have imputed knowledge of the cable location, concluding the plaintiff was required to give notice of its location. Plaintiff's assertion of negligence per se was rejected, the court pointing out that the primary purpose of the anchoring regulations was to ensure safe surface navigation rather than protection for submarine cables. The lower court's decision for plaintiff was reversed. (Hart-Florida)

W71-02165

GULF STATES STEEL CO V LAW (LIABILITY FOR FLOOD DAMAGE BY DAM OWNER).
141 So 641-645 (Ala 1932).

Descriptors: *Alabama, *Obstruction to flow, *Dams, *Natural flow doctrine, Streams, Overflow, Judcial decisions, Legal aspects, Damages, Creeks, Dam construction, Rainfall intensity, Crop response, Natural flow, Backwater, Diversion, Diversion losses, Diversion dams, Easements, Riparian land, Riparian rights, Riparian waters, Relative rights, Reasonable use.

Plaintiff landowner brought action to recover damages for crop destruction by water caused by a dam constructed by defendant corporation across a creek on which plaintiff's property was located. Defendant contended the injury was caused by unusual rainfall and would have resulted even in the absence of its dam. The Supreme Court of Alabama stated that a landowner may maintain a dam across a natural stream for reasonable purposes but cannot impound water in such quantities as to make the stream flood others' lands. The court ruled that plaintiff had the right to have the stream flow in its natural course, that defendant's dam had caused the water of the stream to back up onto plaintiff's property and that plaintiff was entitled to damages for the injury caused thereby. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-02166

PEMBROOKE V PENINSULAR TERMINAL CO (POWER OF STATE TO DISPOSE OF SUBMERGED LAND).
146 So 249-264 (Fla 1933).

Descriptors: *Florida, *Navigable waters, *Ownership of beds, *Land tenure, Beds, Tidal waters, Water levels, Federal government, Federal jurisdiction, State jurisdiction, State governments, Navigation, Channels, Islands, Bays, Overflow, Riparian rights, Administrative agencies, High water mark, Low water mark, Shores, Dredging, Tides, Judicial decisions, Legal aspects, Public rights.

Complainant corporation sought to obtain the balance of money owed to it by defendant for land purchased. The land was located on an island which had originally been submerged bottom land. Defendant denied that complainant could convey good title and sought rescission and return of money already paid. The trial court struck defendant's allegations for affirmative relief and the Supreme Court of Florida affirmed. Defendant's contention that the statutes under which the land was originally sold were void was without merit. Such statutes were not unconstitutional, did not interfere with the public's interest in navigation, fishing and other purposes and were not in conflict with the paramount jurisdiction of the federal government over navigable waters. Defendant's contention that the original deed from the state trustees was void because the submerged land was under too great a depth of water was also rejected. Such a contention amounted to a collateral attack upon the grant by the trustees, and such an attack is not permissible in a suit between private parties. Finally, defendant's contention that the federal government's power to remove obstructions from navigable waters consituted an encumbrance to the title was without merit. Such power was not an encumbrance which warranted rescission of the contract. (Duss-Florida)
W71-02167

STATE EX REL LANDIS V ROSENTHAL (EXCLUSIVE FRANCHISE FOR BRIDGE OPERATION).
148 So 769-776 (Fla 1933).

Descriptors: *Florida, *Permits, *Bridges, *Bridge construction, Legislation, State governments, Local governments, Navigable waters, Beds under water, Highways, Federal government, Administrative agencies, Administrative decisions, Remedies, Judicial decisions, Legal aspects, Public rights.

Defendant had been granted an exclusive franchise to build and operate a toll bridge over navigable state waters. The franchise was conditioned on approval by the state road department and the United States War Department. In an action of quo warranto, the state sought the ouster of defendant from the project on the grounds that such an exclusive franchise was beyond the authority of the statute allowing private licenses for such projects to be granted. The Supreme Court of Florida, holding that navigable waters and lands underlying them are held by the state in trust for its citizens, granted the petition for ouster. The court also ruled that when the state delegated its power to the county, certain limitations on the power were inherent in the grant. Disallowance of the ability to create an exclusive franchise was such a limitation. (Barker-Florida)
W71-02168

CITY OF SHREVEPORT V WILKINSON (CONSTITUTIONALITY OF ORDINANCE DENYING ACCESS TO LANDOWNER'S HOME).
182 La 783, 162 So 621-622 (1935).

Descriptors: *Louisiana, *Water supply, *Supervisory control (Power), *Cities, Local governments, Governments, State governments, Federal government, Legal aspects, Judcial decisions, Lakes, Land, Real property, Water pollution, Legislation, Water pollution control, Adjudication procedure, Navigable waters, Regulation.

Defendant was arrested pursuant to a city ordinance prohibiting passage of boats on a lake at night. The state had conveyed the bed of the lake to plaintiff city and delegated to the city the right to enforce regulations to protect the lake's water from contamination as a water supply. Defendant had erected a recreation home on an island in the lake and was arrested while conveying guests to the shore. Defendant contended that the city ordinance was unconstitutional as an unreasonable exercise of the police powers of the state. The Supreme Court of Louisiana affirmed a judgment for defendant. The ordinance was valid on its face as a reasonable exercise of the delegated power to protect the water supply. However, its rigid enforcement against a landowner, denying him access to his home, was unreasonable. Boats were not prohibited from traversing the lake in the daylight hours and little could be gained by prohibiting passage by defendant at night. (Dye-Florida)
W71-02169

ILHENNY V BROUSSARD (DIVERSION OF WATERS FROM NAVIGABLE STREAMS).
172 La 895, 135 So 669-670 (1931).

Descriptors: *Louisiana, *Diversion, *Navigable waters, *Alteration of flow, Obstruction to flow, Remedies, Legal aspects, Adjudication procedure, Judicial decisions, Navigation, Navigable waters, Streams, Canals, Structures, Flow, Natural streams, Running waters, Public rights, Watercourses (Legal).

Plaintiff sought to enjoin defendant from using his private navigable canal. Defendant contended that plaintiff had diverted so much water into his canal from a previously navigable watercourse that the watercourse was no longer navigable. Defendant contended that plaintiff's diversion authorized the public to make free use of the waters in their new artificial channel. Plaintiff contended that the navigability of the natural stream was in no way diminished. The Supreme Court of Louisiana affirmed a judgment for plaintiff. Plaintiff's canal was private, and defendant was not authorized to trespass on it. If the natural watercourse had in fact been rendered non-navigable, plaintiff might have been enjoined from further diversion. Defendant's proper remedy was appealed to the Secretary of War, whose powers included regulation of navigable streams, or a suit to enjoin plaintiff from diverting so much water as to impede the navigability of the natural watercourse. (Dye-Florida)
W71-02170

FLORIDA EAST COAST RY V ACHESON (LIABILITY FOR OBSTRUCTION TO NAVIGATION).
135 So 551-553 (Fla 1931).

Descriptors: *Florida, *Accidents, *Ships, *Navigable waters, Adjudication procedure, Legal aspects, Hazards, Judicial decisions, Admiralty, Oceans, Piles (Foundations), Structures, Railroads, Damages.

Plaintiff ran his boat into a piling in a navigable channel. Plaintiff sought damages, introducing evidence that defendant railroad had placed pilings in the channel 16 years prior to the accident. The Supreme Court of Florida reversed a judgment for plaintiff. The court stated that some negligence on the part of defendant had to be shown which directly contributed to the injury complained of. The court held that evidence that defendant once placed pilings in the channel was not sufficient to sustain a verdict for plaintiff without a showing that it was one of defendant's pilings which was encountered. (Dye-Florida)
W71-02171

VOLENTINE V HOUSEMAN (LIABILITY FOR OBSTRUCTING DRAINAGE DITCH).
130 So 863-864 (La 1930).

Descriptors: *Louisiana, *Ditches, *Surface drainage, *Obstruction to flow, Legal aspects, Judicial decisions, Damages, Drainage, Surface waters, Surface runoff, Channels, Channel flow, Flow, Crops, Erosion, Overflow, Culverts, Riddance (Legal aspects), Highways.

Plaintiff landowner sued for damage to his land and crops allegedly caused when defendant landowner obstructed a ditch, thereby causing surface water to overflow plaintiff's land. Defendant denied that the overflow was his fault. Plaintiff's land was lower than defendant's, and the two tracts were separated by a street. A natural drain had been converted into a ditch which carried surface water through defendant's land and through a culvert under the street. A continuation of the ditch carried the water from plaintiff's land. The Court of Appeal of Louisiana, in affirming a judgment for plaintiff, found that defendant, in clearing his land of lumber and brush, had placed the debris in his ditch and it clogged the culvert, causing water to flow over the street rather than through the ditch and to flood plaintiff's land. Defendant thus was liable for obstructing the natural flow since an upper proprietor may not increase the burden of the servitude of a lower estate. (Morris-Florida)
W71-02172

SCRANTON-PASCAGOULA REALTY CO V CITY OF PASCAGOULA (ARTIFICIAL CHANNEL MAY BECOME WATERCOURSE BY PRESCRIPTION).
128 So 73-76 (Miss 1930).

Descriptors: *Mississippi, *Watercourses (Legal), *Artificial watercourses, *Culverts, Channel improvement, Legal aspects, Judicial decisions, Remedies, Bayous, Cities, Local governments, Legislation, Channels, Channel flow, Concrete structures, Drainage systems, Drainage, Prescriptive rights.

Plaintiff landowner sought an injunction against defendant city to prevent construction of an enlarged culvert beneath a city street. Plaintiff, whose land would be damaged by discharge from the concrete culvert, claimed it violated a statute which allowed the city to change the channels of watercourses only after voter approval. Defendant contended

that the culvert was not a watercourse and that it was not changing the channel. The Supreme Court of Mississippi, in reversing a lower court disallowance of the injunction, found that the old culvert was constructed by a ship building company as a drainage substitute when it filled in part of the adjoining bayou. It was thus originally an artificial channel, but by prescription had become a watercourse. The new culvert would be larger and carry a greater volume of water, thus amounting to a change of the channel. This the city could not do under the statute. (Morris-Florida)
W71-02173

MARTIN V LOUISIANA PUB UTIL CO (RIGHTS OF PARTIES UNDER WATER CONTRACT).
127 So 470-472 (La 1930).

Descriptors: *Louisiana, *Contracts, *Water contracts, *Prescriptive rights, Sewers, Contract administration, Judicial decisions, Legal aspects, Drainage, Drains, Sewage, Aqueducts, Conduits, Waste water disposal, Utilities.

Plaintiff brought action for the restoration of services from defendant utilities company on the theory that he had acquired by prescription the servitude of draining the refuse water from his private residence through a sewer owned by defendant. Plaintiff contended that in years past he had contracted with defendant's predecessor for the use of the sewer for drainage on the condition that he would buy his water from defendant's predecessor, that he had complied with the contract and that therefore he had obtained a servitude on the sewer now owned by defendant. Defendant denied such an agreement and any resulting prescriptive right. The court ruled that plaintiff had simply had a contract with the predecessor of defendant, that defendant had assumed no obligation thereunder and that plaintiff could not have obtained a prescriptive right as claimed under the contract. The judgment for defendant was affirmed. (Price-Florida)
W71-02174

BAKER V VOSS (TITLE TO BEDS OF NAVIGABLE WATERS).
259 NW 413-415 (Wis 1935).

Descriptors: *Wisconsin, *Ownership of beds, *Navigable waters, *Access routes, Public rights, Lakes, Streams, Boundaries (Property), Beds, Beds under water, State governments, Riparian rights, Relative rights, Remedies, Judicial decisions, Legal aspects.

Plaintiffs sought to enjoin defendant from interfering with plaintiffs' access to an allegedly navigable lake which lay within the boundaries of defendant's land. The lake was joined to another, smaller lake by a shallow, narrow stream, and only a small portion of the second lake was outside of defendant's property. The neighboring landowners allowed the public to enter upon the smaller lake, but defendant erected a fence across the stream, thus preventing entry to the larger lake. The trial court found all the waters in question to be navigable and granted the injunction. Affirming, the Supreme Court of Wisconsin ruled that the state has title to the beds of all navigable waters, whether meandered or not. An injunction will lie against interference with the public rights in such navigable waters. (Barker-Florida)
W71-02175

ERICKSON V COUNTY OF STEARNS (LIABILITY OF COUNTY FOR DAMAGES FROM DAM OPERATION).
252 NW 219-221 (Minn 1934).

Descriptors: *Minnesota, *Dam construction, *Water levels, *Flood damage, Damsites, Dams, Operation and maintenance, Height, Lakes, Local governments, Legislation, Administrative agencies, Elevation, Jurisdiction, State jurisdiction, Land, Riparian land, Floods, Flooding, Remedies, Judicial decisions, Legal aspects.

Plaintiff riparian landowner brought an action for damages caused by defendant county's alleged improper maintenance of a dam on a certain lake. The major portion of the lake lay within another county, but a small part was within defendant's boundaries. Under Minnesota law, the state delegated its power over control of water levels in navigable waters to the several counties, and petition was made to defendant county to establish a dam to control the level in the portion of the lake within its boundaries. The dam was constructed by the state game and fish department, with defendant agreeing to pay half the costs. Plaintiff's property was flooded as a result of the dam, and the dam was removed when defendant required the game and fish department to do so. Defendant denied liability for plaintiff's damage under the doctrine of ultra vires. The trial court accepted the defense that defendant could not be liable since it had no authority over the dam's maintenance, and the case was dismissed. Affirming, the Supreme Court of Minnesota ruled that the legislature could not have attempted to give a county control over a lake, the major portion of which lay in another county. Therefore, defendant had no interest in the lake, and any attempt to exercise an interest was ultra vires. (Barker-Florida)
W71-02176

HAASE V KINGSTON CO-OPERATIVE CREAMERY ASS'N (OWNERSHIP OF LAND UNDER ARTIFICIAL LAKE).
250 NW 444-445 (Wis 1933).

Descriptors: *Wisconsin, *Ownership of beds, *Relative rights, *Land tenure, Beds, Beds under water, Dams, Damsites, Ponds, Ponding, Public rights, Recreation, Ice, Lake ice, Riparian rights, Artificial watercourses, Water utilization, Remedies, Judicial decisions, Legal aspects.

Plaintiff landowner sought to recover the value of ice taken by defendant from a pond on plaintiff's property. Plaintiff's predecessor had constructed a dam whereby the pond was created. The public had been allowed full access to the pond. Defendant argued that such public access had vested title to the lake and the land beneath it in the state by adverse possession, thus giving the public the right to harvest the ice. The Supreme Court of Wisconsin, in affirming the trial court's decision for plaintiff, ruled that a landowner may permit the public to enjoy an artificial body of water, and such allowance may ripen into a dedication which the owner may not abolish. However, such dedication does not constitute adverse possession in the state. Ownership in the lake and underlying property was held to remain in plaintiff, and recovery for the value of the ice was allowed. (Barker-Florida)
W71-02177

FLAMBEAU RIVER LUMBER CO V GETTLE (RIGHT OF LUMBER COMPANY TO HAVE RIVER NAVIGABLE FOR DRIVING LOGS).
236 NW 671-679 (Wis 1931).

Descriptors: *Wisconsin, *Lumbering, *Impounded waters, *Reservoirs, Alteration of flow, Discharge (Water), Legal aspects, Judicial decisions, Dams, Saw mills, Equalizing reservoirs, Navigation, Navigable rivers, Reservoir operation, Water levels, Administrative agencies, Riparian rights, Water rights.

The Railroad Commission, of which defendant was a member, issued an order authorizing the retention of all the flow of a river, except 150 cubic feet per second, during the time when logs were being driven upon said river. Plaintiff lumber company was forced to abandon its log drives. Plaintiff brought an action to have the Commission's order vacated, alleging that plaintiff was deprived of its right of navigation upon the river. Plaintiff also alleged that 1300 cubic feet of water per second was needed to conduct log drives. Defendant alleged that the Commission was empowered to control drawing of water from river reservoirs in order to maintain uniform flow. The Supreme Court of Wisconsin affirmed the lower court's decision vacating the Railroad Commission's order. The court held that plaintiff was entitled to water at times and in quantities necessary to make the river navigable for driving logs. The court also held that it was unauthorized to determine the quantity of water reasonably necessary in the river for log driving, such determination being an administrative matter. (Powell-Florida)
W71-02178

DELTA FISH AND FUR FARMS V PIERCE (STATUS OF WATERS PREVIOUSLY ADJUDGED NON-NAVIGABLE).
234 NW 881-886 (Wis 1931).

Descriptors: *Wisconsin, *Navigable waters, *Public rights, *Non-navigable waters, Adjudication procedure, Judicial decisions, Legal aspects, Relative rights, Land, Real property, Recreation, Hunting, Fishing, Diversion, Drainage districts, Streams, Rivers, Navigation.

Plaintiff muskrat framing company sought to restrain defendants from trespassing on its inundated land for the purpose of hunting and fishing. Defendants contended the water on plaintiff's land was navigable and therefore subject to public recreation. Plaintiff's property had formerly been covered by the waters of a navigable stream which had been diverted under an action brought by a local drainage district. The court in that action found that no navigable water would remain on plaintiff's property after the diversion. In reversing a judgment for defendants, the Supreme Court of Wisconsin held that the question of the navigability of the waters on plaintiff's property was res judicata. The proceeding brought by the drainage district was in rem and conclusive of all questions therein adjudicated. Some petitioners in the proceeding had argued the exact issue presented by defendants. Since the waters were adjudged non-navigable, no rights thereafter existed in the public to trespass on plaintiff's land. (Dye-Florida)
W71-02179

PFANNEBECKER V CHICAGO RI AND P RY (LIABILITY FOR DAMAGES RESULTING FROM TWO OR MORE CAUSES).
226 NW 161-164 (Iowa 1929).

Descriptors: *Iowa, *Obstruction to flow, *Adjudication procedure, *Damages, Remedies, Legal aspects, Judicial decisions, Flow, Floods, Flooding, Precipitation excess, Streams, Railroads, Alteration of flow, Bridges, Crops, Overflow, Banks, Flood damage, Rain water, Structures.

Plaintiff's property lay in a valley through which passed a stream. Defendant railroad constructed an embankment and bridge across the valley downstream from plaintiff. During a period of heavy rains, plaintiff's fields were flooded and his crops destroyed. Plaintiff brought action against defendant for damages, contending that the floodwaters were turned from their natural course by defendant's embankment and backed onto his property. The Supreme Court of Iowa reversed a judgment for plaintiff. Plaintiff's own evidence suggested that part of his damage resulted from normal overflow of the stream. Plaintiff was unable to segregate with any certainty the damage caused by defendant's embankment and that which would have otherwise occurred. Despite instructions by the trial judge that if any damage resulted from causes other than defendant's embankment plaintiff was not entitled to a verdict, the jury returned a verdict for plaintiff. The court held that the jury was in error. The extent of defendant's liability as established by plaintiff was too speculative to warrant a judgment. (Dye-Florida)
W71-02180

PIKE RAPIDS POWER CO V SCHWINTEK (SPECIFIC PERFORMANCE OF CONTRACT TO CONVEY FLOWAGE RIGHTS).
223 NW 612-614 (Minn 1929).

Descriptors: *Minnesota, *Dams, *Backwater, *Contracts, Design flood, Maximum probable flood, Land tenure, Real property, Flooding, Flood damage, Hydroelectric plants, Lumber, Judicial decisions, Legal aspects.

Plaintiff power company sought specific performance of a contract against defendant riparian landowner for the conveyance of certain flowage rights. Defendant's predecessor sold flowage rights to plaintiff over part of his land and agreed to convey flowage rights for any remaining land which might be overflowed for $50 an acre. The dam caused flowage over 35 more acres than originally conveyed, but defendant refused to convey the flowage rights for this additional land upon plaintiff's tender of the agreed price. Defendant contended that: (1) there was no meeting of the minds; (2) there was no consideration for the conveyance; (3) he adversely possessed the lands; and (4) specific performance would be inequitable. The court found that defendant had failed to sustain the burden of showing an inadequate meeting of minds. Defendant's contention of no consideration was rejected since the payment of $50 an acre for the additional land was obviously adequate consideration. Defendant's additional contentions were rejected as frivolous, and the lower court's decision for plaintiff was affirmed. (Hart-Florida)
W71-02181

BEAVERTON POWER CO V WOLVERINE POWER CO (BREACH OF ORAL CONTRACT TO CONVEY FLOWAGE RIGHTS).
222 NW 703-705 (Mich 1929).

Descriptors: *Michigan, *Dams, *Backwater, *Contracts, Design flood, Maximum probable flood, Land tenure, Real property, Flooding, Flood damage, Claims (Contracts), Hydroelectric plants, Damages, Compensation, Judicial decisions, Legal aspects, Adjudication procedure, Relative rights, Competing uses.

Plaintiff power company sought specific performance of an alleged contract with defendant power company to release flowage rights to certain riparian farmland. Defendant assured plaintiff that its dam would not back water to the point of the Weinboldt and Hunter farms, which were located across a river from one another. Defendant owned both farms. Relying upon defendant's assurance, plaintiff purchased the Hunter farm outright, and purchased the Weinboldt farm subject to defendant's flowage rights thereon. Plaintiff contended that defendant had agreed to release the Weinboldt flowage rights for $600. Defendant alleged that plaintiff had agreed to sell flowage rights on the Hunter farm if defendant's dam backed water over it. Both the alleged agreements were oral. The court determined that flowage rights were interests in land and could only be purchased by a written instrument under seal. Accordingly, the court refused to enforce the rights asserted by either party. However, the court awarded plaintiff more than the value of the land overflowed by defendant's dam since it was purchased with defendant's assurance that such land would not be overflowed. (Hart-Florida)
W71-02182

ANDERSON V OTTER TAIL POWER CO (LIABILITY FOR BREACH OF COVENANT TO PROVIDE POWER FROM DAM).
220 NW 404-406 (Minn 1928).

Descriptors: *Minnesota, *Dams, *Contracts, *Flooding, Judicial decisions, Legal aspects, Land tenure, Real property, Water supply, Water contracts, Dam construction, Damsites, Adjudication procedure.

Plaintiff landowner sued defendant power company for damages for breach of covenant. Plaintiff owned property containing a dam. Plaintiff sold the property to defendant's predecessor, who agreed to provide 20 horsepower to plaintiff from that dam or any future dam which might be built. Plaintiff continued to operate the dam, but permitted it to fall into disrepair. Defendant subsequently purchased the tract and built another dam downstream, flooding the old dam. Plaintiff contended that defendant was required by the covenant to erect a new dam on the original damsite. Plaintiff further alleged that flooding of the damsite created a right of damages and that defendant was required to provide the specified power from the lower dam. Defendant contended that the covenant did not run with the land and that it did not require erection of a new dam. The court refused to decide whether the covenant ran with the land since it held that the terms of the covenant clearly provided no obligation to build a new dam. The court also determined that the covenant did not create a right of damages or right to water power. The lower court's decision for plaintiff was reversed. (Hart-Florida)
W71-02183

CITY OF BARABOO V RAILROAD COMM'N (JUDICIAL REVIEW OF ADMINISTRATIVE ORDER TO LOWER DAM HEIGHT).
218 NW 819-820 (Wis 1928).

Descriptors: *Wisconsin, *Dams, *Administrative agencies, *Legislation, Water levels, Power head, Height, Tailwater, Water level fluctuations, State governments, Cities, Judicial decisions, Legal aspects, Adjudication procedure, Administrative decisions, Regulation, Supervisory control (Power), Navigable waters.

Plaintiff city brought action to set aside an order of defendant commission requiring plaintiff to lower its dam two inches. The dam was authorized by legislation. Among other things, plaintiff contended that it had a right to maintain a 14 ft. dam, whereas the dam which defendant had ordered lowered was only 12 1/2 ft. high. To establish this contention, plaintiff had offered evidence that the dam was higher at a time before the authorizing legislation for the present dam was enacted, but the trial court refused to consider this evidence. The Supreme Court of Wisconsin pointed out that even if the higher level were established, plaintiff could only maintain the waterhead the legislature authorized. A state may refuse permission to a riparian owner to build a dam in a navigable stream or it may attach conditions to its consent. The court held that defendant's order was proper and affirmed the lower court's decision for defendant. (Hart-Florida)
W71-02184

ANGELO V RAILROAD COMM'N (CONSTITUTIONALITY OF CONTRACT TO REMOVE MARL FROM LAKEBED).
217 NW 570-577 (Wis 1928).

Descriptors: *Wisconsin, *Contracts, *Riparian rights, *Ownership of beds, Beds under water, Legislation, Navigable waters, Lakes, Administrative agencies, Administrative decisions, State governments, Eminent domain, Permits, Lake beds, Lake soils, Navigation, Marl, Calcareous soils, Calcium compounds, Caliche, Grants, Judicial decisions, Legal aspects.

Plaintiff littoral landowners brought action to have the acts of defendant Railroad Commission which granted a right to remove marl from a navigable lake declared unconstitutional. Defendant was authorized by legislation to contract for removal of material from navigable lake beds and to determine compensation to be paid the state therefor. Plaintiffs contended that any removal contract would unconstitutionally violate their riparian rights. The court noted that: (1) the state constitution declared a public trust in navigable waters for navigation, but not to the land thereunder; (2) a riparian owner on a navigable lake does not hold title to the lakebed, because title to such beds is in the state; (3) in absence of a legislative declaration, whether a lake is navigable is a fact question; and (4) the state may only destroy riparian rights through exercise of the eminent domain power. Since the littoral landowners did not have title in the lakebed, the court concluded that the statute was not an improper exercise of the police power and held that defendant could properly execute a contract for removal of marl without violating plaintiffs' riparian rights. However, the lower court's decision for defendant was reversed on other grounds. (Hart-Florida)
W71-02185

MILLER V PERKINS (OBSTRUCTION OF SURFACE RUNOFF).
216 NW 27-29 (Iowa 1927).

Descriptors: *Iowa, *Diversion, *Obstruction to flow, *Surface runoff, Natural flow, Natural flow doctrine, Culverts, Ditches, Judicial decisions, Legal aspects, Diversion structures, Diversion dams, Drainage, Overflow, Right-of-way, Railroads, Tile drains, Backwater, Crop response, Surface drainage.

Plaintiff sought to enjoin defendant from obstructing the natural flow of surface runoff from plaintiff's dominant estate. Defendant had constructed a ditch between the two pieces of property to prevent the overflow from coming onto his property. The parties stipulated that the ditch should have been maintained so as not to cause water to be backed up onto plaintiff's property. There was disagreement as to just how said ditch was to be maintained. Defendant's tenant had constructed a dam that also caused water to back up to plaintiff's injury, but did so only when defendant's ditch was improperly maintained. The court ruled that defendant could prevent the surface water from flowing over his property if in doing so he did not prejudice plaintiff. The case was remanded to have determined the issue of the sufficiency of defendant owner's ditch and to consider the need for enjoining the maintenance of defendant's tenant's dam. (Price-Florida)
W71-02186

CITY OF MILWAUKEE V STATE (SALE OF SUBMERGED LANDS TO AID NAVIGATION).
214 NW 820-832 (Wis 1927).

Descriptors: *Wisconsin, *Navigation, *Ownership of beds, *Public rights, Legislation, Judicial decisions, Legal aspects, Navigable waters, Lake Michigan, Shores, Condemnation, Contracts, Lakes, Cities, Relative rights, Harbors, Land tenure, Mississippi River, Great Lakes, Land reclamation, Local governments, State governments, Public health.

Plaintiff city brought action to quiet title to certain submerged lands at the edge of Lake Michigan. Plaintiff claimed the land through a grant from the state legislature. Defendant state contended that the land had to be held in trust for the public and be utilized only in aid of navigation. Plaintiff had agreed to convey title to the land to a private corporation in exchange for a piece of property owned by said corporation which plaintiff considered vital to the successful construction of port facilities. After considerable deliveration, the court found that the granting of the land to the corporation and the subsequent construction of a pier thereon would not be a violation of the trust doctrine but rather a necessary step to be taken in the aid of navigation and commerce. The judgment of the lower court in favor of plaintiff was affirmed. (Price-Florida)
W71-02187

MELANDER V FREEBORN COUNTY (DAMAGES TO LAND AND CROPS AS A RESULT OF DAM CONSTRUCTION).
212 NW 590-591 (Minn 1927).

Descriptors: *Minnesota, *Lakes, *Dams, *Water levels, Navigable waters, Meanders, Judicial decisions, Legal aspects, Watersheds (Basins), Public rights, Flooding, Administration, Dam construction, Erosion, Crops, Obstruction to flow, Outlets, High water mark, Discharge (Water), Floodwater, Local governments.

Plaintiffs were riparian landowners upon a navigable lake. Their land was usually tillable, but portions of it was marshy and flooded when the level of the lake was high. Defendant county built a dam across the outlet of the lake to maintain the water at its 'usual' level. Plaintiffs brought an action for damages, claiming that the dam held the water higher than state law authorized. The trial court found that the dam was in no way an obstruction to flow and that plaintiffs' lands and crops were never flooded as a result of the dam construction. The height of the water was found to be controlled by the subcrests of the dam and not by that balance of the dam extending above the height of the subcrest. The Supreme Court of Minnesota affirmed the lower court's decision for defendant, finding that the dam held the water at a level no higher than that which nature had prior to the dam's construction. Defendant had complied substantially with state statutes in building the dam to maintain the water at its natural level. (Barnett-Florida)
W71-02188

THE COLOMBO (FEDERAL STATUTE PROHIBITING POLLUTION OF NEW YORK CITY HARBOR).
28 F2d 1004-1005 (SD NY 1928).

Descriptors: *New York, *Admiralty, *Water pollution, *Navigable waters, Legislation, Harbors, Ships, Oil, Oil wastes, Sludge, Judicial decisions, Legal aspects, Oily water, Adjudication procedure, Accidents, Federal government, United States, Water pollution control, Water pollution sources.

The United States brought libel action against a steamship for dumping oil into New York harbor in violation of a federal act prohibiting the discharge of injurious deposits into the harbor or adjacent waters. The court dismissed the action, holding that the statute must be strictly construed and cannot be said to be violated when a barge pumped valuable oil into the sea through a valve on the ship which unknowingly had been left open. (Duss-Florida)
W71-02189

MATTER OF FORD (COMPENSATION FOR DEPRESSED LAND VALUES WHERE REDUCED WATER SUPPLY UPSET RIVER'S ECOLOGY).
313 NYS2d 42-52 (App Div 1970).

Descriptors: *New York, *Eminent domain, *Water supply, *Compensation, Land tenure, Easements, Real property, Land appraisal, Land use, Right-of-way, Dams, Cities, Administrative agencies, Fishing, Swimming, Boating, Ecology, Balance of nature, Rivers, Judicial decisions, Legal aspects, Damages, Water resources, Water shortage, River flow.

The Board of Water Supply of the City of New York appealed from a decision affirming the report of commissioners of appraisal in eminent domain proceedings. Appellant had condemned water from a river to supply its inhabitants. The subsequent impairment of the river flow upset the ecology of the river, destroying its usefulness for swimming, boating and fishing. Accordingly, the market values of properties downstream from appellant's dam were depressed. In one instance respondent claimed indirect damage to a non-riparian tract, contending that it was the dominant tenement in an appurtenant right-of-way to the river. Determining that the right-of-way did not apply to that tract, the court disallowed compensation. The court also found that two other tracts for which respondent had claimed compensation were conveyed prior to appellant's condemnation and disallowed compensation for these tracts. The commissioners' orders were affirmed in part and reversed in part. (Hart-Florida)
W71-02190

THOMPSON V WATER RESOURCES COMM'N (JUDICIAL REVIEW OF DREDGING PERMIT).
267 A2d 434-438 (Conn 1970).

Descriptors: *Connecticut, *Dredging, *Landfills, *Permits, Administrative agencies, Administrative decisions, State governments, Decision making, Channels, Streams, Backfill, Land development, Marshes, Ecology, Balance of nature, Legislation, Legal aspects, Judicial decisions.

Plaintiff landowner brought action to repeal defendant commission's grant of a dredge permit to an adjoining landowner. The adjoining landowner wished to dredge and fill his riparian property in order to subdivide it for high-grade residences. He intended to use the dredged material to fill in an artificial channel and a concave area along his shore. He applied to defendant for a dredge permit as required by statute. The statute required defendant, in rendering the decision, to consider the area's ecology, the rights of other owners, and navigation. The permit was opposed by 60% of the neighboring landowners, who contended that the area's basic ecology would be upset by the dredging. Defendant conducted a public hearing and concluded that the proposed dredging would injure the ecology only slightly and that certain aspects of the ecology would be improved. Plaintiff contended that defendant's only legal decision was to deny the permit. The court found that defendant had properly examined all required considerations and that the evidence amply supported defendant's decision. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-02191

JACKVONY V POWEL (PUBLIC PASSAGE BETWEEN HIGH AND LOW WATER MARKS).
21 A2d 554-558 (RI 1941).

Descriptors: *Rhode Island, *Public rights, *Beaches, *Access routes, Boundaries (Property), Local governments, Administrative decisions, Community development, Judicial decisions, Land tenure, Legal aspects, Legislation, Proprietary power, Recreation, Relative rights, Riparian land, State governments, High water mark, Low water mark, Barriers.
Identifiers: *Constitutionality, Fences.

By special act the Rhode Island legislature clothed defendant City Commission of Newport with authority to take charge of and control the beachfront within the city limits, including the shores thereof between the high and low water marks. Pursuant to this act, the city proposed to fence in the beach within the city limits down to the low water mark. Plaintiff attorney general sued to enjoin such construction on the grounds that the special act was unconstitutional. The state constitution provided that the people would continue to enjoy all the rights and privileges of the shore. The court held that such rights and privileges included the right to public passage along the shore, subject, possibly, to reasonable regulation. The act was found to be unconstitutional in that the powers it vested in the commission were too broad and unrestricted to assure that public passage would not be materially impaired. (Clarke-Florida)
W71-02192

HOLYOKE WATER POWER CO V WHITING AND CO (UNAUTHORIZED USE OF WATER SUPPLY).

276 Mass 528, 177 NE 568-574 (1931).

Descriptors: *Massachusetts, *Water utilization, *Water contracts, *Water supply, Dams, Mill dams, Industrial plants, Canals, Water rates, Water rights, Relative rights, Artificial use, Grants, Industrial production, Dam design, Networks, Network design, Remedies, Adjudication procedure, Judicial decisions, Legal aspects, Contracts.

Plaintiff water power company sought to enjoin defendant from using water supplied by plaintiff in a manner different than the stated restrictions in certain grants of water rights from plaintiff to defendant. Plaintiff alleged that defendant used water on lands to which the supply was not appurtenant, used amounts of water in excess of the grants, was planning to use the supply for purposes prohibited in the grants and operated its water gates during hours not contemplated in the grants. Defendant argued that the alleged improper uses were not expressly prohibited by the grants. Ruling that grants such as those in question must be interpreted in light of all the normal material circumstances and not in light of the words alone, the Supreme Judicial Court of Massachusetts granted the injunction sought by plaintiff. The court stated that use of water for unauthorized purposes is a sufficient ground for equitable relief. (Barker-Florida)
W71-02193

BELKUS V CITY OF BROCKTON (LIABILITY FOR FLOOD DAMAGE FROM BLOCKED STREAM).
184 NE 812-15 (Mass 1933).

Descriptors: *Massachusetts, *Flood damage, *Drainage practices, *Remedies, Cities, Local governments, Legislation, Streams, Drainage, Drainage systems, Floods, Flooding, Damages, Water levels, Pipes, Obstruction to flow, Adjudication procedure, Judicial decisions, Legal aspects.

In an action to recover for flood damages, plaintiff contended that defendant city negligently operated its drainage system. After the city had improved a series of watercourses in order to facilitate better drainage, pipes were laid in streams where required. Plaintiff claimed that the water levels of such streams were raised and that resulting backwater flooded the basement of his building. Defendant claimed that it was acting pursuant to legislation, and any damages should be recoverable on the theory of a taking, not under tort action. Finding that the damages were caused by the negligence of defendant, the Supreme Judicial Court of Massachusetts ruled that tort was the proper action in such a case. The court further ruled that the measure of damages in a temporary nuisance was the combination of the amount spent by plaintiff to remedy the damage and the diminution of rental value while the injury continued. (Barker-Florida)
W71-02194

CAPE ROMAIN LAND AND IMPROVEMENT CO V GEORGIA-CAROLINA CANNING CO (OWNERSHIP OF LAND BETWEEN HIGH AND LOW WATER MARKS).
146 SE 434-440 (SC 1928).

Descriptors: *South Carolina, *Ownership of beds, *Low water mark, *High water mark, Legal aspects, Judicial decisions, Remedies, Damages, Tidal waters, Tides, Navigable waters, Bays, Navigable rivers, Boundaries (Property), Coastal marshes, Wetlands, Public rights, State governments, Tides, Prescriptive rights.

Plaintiff land company sought to restrain defendant oyster companies from trespassing on lands plaintiff claimed to own and also sought damages for prior trespasses. Defendants, who had leased the lands from the state, contended that the lands were between the high and low water marks of navigable waters and thus were owned by the state in trust for the people. The Supreme Court of South Carolina affirmed a lower court's decision for defendants. The court stated that title to land on tidal waters runs to the high water mark, the limit of the flux of

the usual tide, unless otherwise shown. The court held that plaintiff failed to produce sufficient evidence to show either a grant or adverse possession to the low water mark. The fact that plaintiff's deed specified marshland was insufficient since marshland can be dry in some seasons. A dissenting opinion noted that of 34,290 acres of marshland plaintiff's predecessors purchased from the state, only 6.2 acres were above the high water mark. Thus, although the deeds did not specify that title was to extend to the low water mark, that construction would be more reasonable. (Morris-Florida)
W71-02195

LANGERIN V FLETCHER (INTERPRETATION OF 'BANK' AS PROPERTY BOUNDARY).
273 Mass 543, 174 NE 194-196 (1931).

Descriptors: *Massachusetts, *Boundaries (Property), *Banks, *Ravines, Legal aspects, Judicial decisions, Remedies, Ownership of beds, Watercourses (Legal), Streams, Channels, Streambeds, Riparian land, Boundary disputes, Adjudication procedure.

Petitioner sought to register title to a ravine through which a small brook formerly flowed. Petitioner previously had owned land on both sides of the brook, but later granted title to land on the south side to the predecessors in title of respondent. The deed to such land specified the grant was 'to the southerly bank of a brook.' Respondents contended this meant to the actual high water mark of the water, but petitioners claimed it meant only to the top of a high bank at the edge of the ravine. The Supreme Judicial Court of Massachusetts affirmed a lower court opinion that the deed was abmiguous, and thus evidence was properly admitted which showed that petitioner intended to grant only to the edge of the top of the ravine. Where a word in a deed is ambiguous, the meaning must be obtained from the instrument as a whole and the surrounding circumstances. A grant of land bounded by a bank of a stream generally excludes the bed if such bank has any width apart from the bed. (Morris-Florida)
W71-02196

WHITE V KNICKERBOCKER ICE CO (OWNERSHIP OF BEDS AS AFFECTED BY PROPERTY DESCRIPTION).
254 NY 152, 172 NE 452-455 (1930).

Descriptors: *New York, *Easements, *Boundaries (Property), *Ownership of beds, Banks, Legal aspects, Judicial decisions, Remedies, Lakes, Riparian land, Riparian waters, Riparian rights, Beds under water, Navigable waters, High water mark, Watercourses (Legal), Access routes.

Plaintiff sought to establish an easement over defendant ice company's land to have access to a certain lake. The respective titles of each party's property came from a common grantor. Plaintiff claimed that the grantor had reserved title to the lakebed when he transferred title to the strip of land along the lake which defendant owned. Plaintiff claimed such a reservation would naturally have established an easement for access to the lakebed. Defendant conceded an easement would have been established by reserving title to the lakebed but asserted the deed language 'to the lake' and 'along the side' of the lake carried title to the center of the lake. The Court of Appeals of New York, in reversing a lower court decision for plaintiff, held that where a description in a conveyance of riparian land is so framed as to 'touch' the water, rather than run the boundary on dry land, there is a presumption that it carries title to the center of the body of water. The court found that the word 'side' as used in the deed from the common grantor to defendant's predecessor 'touched' the water and thus did not reserve title to the lakebed to the grantor. (Morris-Florida)
W71-02197

TILLSON V CRANE BROOK CO (LIABILITY FOR THE NEGLIGENT LOWERING OF WATER LEVELS).
269 Mass 493, 169 NE 512-513 (1930).

Descriptors: *Massachusetts, *Great ponds, *Withdrawal, *Water levels, Diversion, Damages, Pumping, Relative rights, Competing uses, Judicial decisions, Legal aspects, Dams, Flumes, Low water mark, Bogs, Cranberries, Permits, Canals, Bench marks, Administration, Water level fluctuations.

Plaintiff brought an action to recover damages for the willful or negligent lowering of a great pond which allegedly prevented him from pumping sufficient water therefrom to overflow his cranberry bogs. Plaintiff alleged that defendant removed the flashboards from its flume for the purpose of lowering the water in the pond below the established low water mark. The Supreme Judicial Court of Massachusetts affirmed the lower court's holding for defendant, finding that there was insufficient evidence to warrant a finding for plaintiff that the lowering of the water level in the pond was a result of defendant's negligence. (Barnett-Florida)
W71-02198

YASKILL V THIBAULT (LIABILITY OF LOWER RIPARIAN OWNER FOR BLOCKING STREAM).
273 Mass 266, 173 NE 504-505 (1930).

Descriptors: *Massachusetts, *Natural flow doctrine, *Obstruction to flow, *Watercourses (Legal), Flood damage, Riparian land, Banks, Riparian rights, Waste water disposal, Water pollution, Cesspools, Natural streams, Ponds, Surface waters, Walls, Dams, Diversion dams, Water control, Legal aspects, Judicial decisions, Remedies.

Plaintiff riparian owners sought an injunction against defendant lower riparian owner to require removal of an obstruction which caused water to flood plaintiff's lands. Defendant constructed a cement wall on his land, causing water to back up which ordinarily had flowed away naturally. Defendant contended the water was not a natural stream because there was an area between a pond and a river in which the water spread over level land before returning to a defined bed. Defendant also sought to defend on the basis that plaintiffs had polluted the water by allowing cesspools to drain into it. The Supreme Judicial Court of Massachusetts upheld the lower court's finding that the course was well-defined enough to make it a natural stream. The court also rejected the pollution defenses, stating that such pollution was an independent wrongful act not related to the wrong and injury suffered by plaintiffs. (Morris-Florida)
W71-02199

PUBLIC UTILITIES COMM'N V EAST PROVIDENCE WATER CO (RIGHT OF WATER COMPANY TO RAISE RATES).
136 A 447-455 (RI 1927).

Descriptors: *Rhode Island, *Public Utilities, *Water rates, *Water rights, Administrative agencies, Water supply, Water utilization, Domestic water, Industrial water, Water users, Public rights, Judicial decisions, Legal aspects, Cities, Legislation, Municipal water.

The Rhode Island Public Utilities Commission instituted an investigation into the reasonableness of proposed increased rates filed by a water company and subsequently approved them. The town and fire district affected by the rate increase appealed this approval to the Rhode Island supreme court, and the court reversed. Among the important factors in the court's reversal was evidence that the water company had divested itself of a pond and the water rights in the pond, and also had allowed two companies to pump water from the pond without payment of compensation. The court stated that, when the pond and water rights were acquired by the water company as a public utility, they became devoted to public use. The company could not divest itself of ownership unless such action was clearly in good faith and the property was not necessary for public use. The water company had argued that those taking water without compensation had a right because they were located on the shores of the bond. However, the court rejected this contention. The water rights were exclusively in the owner of the pond. (Duss-Florida)
W71-02200

6F. Nonstructural Alternatives

THE RELATIONSHIP BETWEEN LAND VALUES AND FLOOD RISK IN THE WABASH RIVER BASIN.
Army Engineer Inst. for Water Resources, Alexandria, Va.
For primary bibliographic entry see Field 06B.
W71-01686

FLOOD PLAIN INFORMATION, TUSCARAWAS RIVER, STARK COUNTY, OHIO.
Corps of Engineers, Huntington, W. Va.
For primary bibliographic entry see Field 04A.
W71-01773

FLOOD PLAIN INFORMATION, EAST FORK STONES RIVER, WOODBURY, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
W71-01774

A METHODOLOGY FOR FLOOD PLAIN DEVELOPMENT AND MANAGEMENT.
TRW Systems Group, Redondo Beach, Calif.

Available from NTIS as AD-704 716, $3.00 in paper copy, $0.95 in microfiche. Army Engineer Institute for Water Resources, IWR Report 69-3, December 1969. 185 p. Contract DACW31-68-C-0042.
Identifiers: *Urban planning, Floods, *Floods, Control, Protection, Industries, Hazards, Roads, Dams, Construction, Arizona, Nevada, Reno (Nevada), Tuscon (Arizona), *Flood plains, *Flood plain management.

A methodology is presented by which the consequences (mainly economic in nature) of choosing various flood plain management alternatives may be evaluated so as to achieve a stated set of objectives. The methodology is commonly known as a trade-off analysis. It is illustrated by two case studies, one for the Reno, Nevada area, and the other in the Tuscon, Arizona area.
W71-01872

FLOOD PLAIN INFORMATION-SOUTH FORK OF THE CROW RIVER, HUTCHINSON, MINNESOTA.
Corps of Engineers, St. Paul, Minn.
For primary bibliographic entry see Field 04A.
W71-01915

FLOOD PLAIN INFORMATION, BIG WILLIS CREEK, VICINITY OF GADSDEN, ALABAMA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-01916

PRINCIPLES AND PROCEDURES IN FLOOD PLAIN MANAGEMENT,
Tennessee Valley Authority, Knoxville.
James E. Goddard, and John W. Weathers.
In: Proceedings, American Society of Civil Engineers, Journal of the Hydraulic Division, Vol 95 No HY4, p 1321-1326, July 1969.

Descriptors: *Flood plains, *Methodology, *Management, *Planning, *Flood control, Coordination, Water resources, Watershed management, Cities.
Identifiers: *Flood plain management, Metropolitan areas, Implementation.

Comprehensive flood plain management is defined as the planning and action to determine, implement, and revise, as needed, plans, for the wise and best use of flood plains and their water resources for the welfare of our nation. The necessity and purpose of changing from the traditional approach is briefly stated. Principles of wise management are presented for communities, cites, metropolitan areas, small watersheds, and large watersheds. Procedures for planning and implementation for the various types of areas ore outlined and examples cited. Flood plain regulations and their role is reviewed. The critical role of close coordination of effort by local, states, and Federal interests is stressed. (Davis-Chicago)
W71-02121

CHAPTER V, FLOOD PLAIN MANAGEMENT AND FLOOD INSURANCE.
For primary bibliographic entry see Field 06B.
W71-02135

COMPUTERS IN FLOOD CONTROL PLANNING,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06B.
W71-02141

STATE FLOOD-PLAIN MANAGEMENT ACTIVITIES,
Oregon State Water Resources Board, Salem.
For primary bibliographic entry see Field 06B.
W71-02147

AMORTIZATION OF NONCONFORMING USES IN FLOOD PLAINS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
William R. Walker.
Journal of the Urban Planning and Development Division, Proceeding of the American Society of Civil Engineers, Vol 96, UP1, p 1-16, March 1970. 10 ref.

Descriptors: *Amortization, *Flood damage, *Flood plains, *Legal aspects, *Flood plain zoning, *Non-structural alternatives, Planning, City planning, Flood zoning.
Identifiers: *Flood plain management, *Flood damage reduction.

The majority of courts appears to sustain zoning ordinances with amortization provisions for eliminating nonconforming uses if the amortization periods is reasonable and the detriment to the individual is small in relation to the benefits to the public. Condemnation, abandonment, prohibiting or limiting extensions and repairs, and amortization are four methods used to eliminate nonconforming uses. Amortization is presented as the best method of removing nonconformities in the flood plain for purposes of reducing flood damages. Some of the prevalent theories of the court and a brief review of the most cited cases are presented to bring about a better understanding of zoning with an amortization plan. (Davis-Chicago)
W71-02151

6G. Ecologic Impact of Water Development

CONCEPTS AND UTILITIES OF ECOLOGIC MODEL,
Water Resources Engineers, Inc., Walnut Creek, Calif.
Carl W. Chen.
In: Proceedings, American Society of Civil Engineers, Journal of the Sanitary Engineering Division, Vol 96, No SA5, p 1085-1097, October 1970. 7 fig, 3 tab, 19 ref.

Descriptors: *Ecology, *Ecosystems, *Model studies, *Mathematical models, Eutrophication.
Identifiers: *Ecologic model, Acquatic ecosystem.

Basic components of an aquatic ecosystem are modified continuously by such ecologic processes as photosynthesis, respiration, zooplankton grazing, fish predation, nutrient recycling, sedimentation and various transport phenomena. A set of differential equations describing these processes can be assembled and operated simultaneously to model physical, chemical and biological behavior of such ecosystem. Preliminary experiments with an ecologic model of this type indicate the reasonableness of the technique. It is concluded that model development and application will greatly aid a more fundamental understanding of eutrophication processes and their control. (Davis-Chicago)
W71-02115

MATTER OF FORD (COMPENSATION FOR DEPRESSED LAND VALUES WHERE REDUCED WATER SUPPLY UPSET RIVER'S ECOLOGY).
For primary bibliographic entry see Field 06E.
W71-02190

THOMPSON V WATER RESOURCES COMM'N (JUDICIAL REVIEW OF DREDGING PERMIT).
For primary bibliographic entry see Field 06E.
W71-02191

07. RESOURCES DATA

7A. Network Design

SATELLITE (ERTS-A) NETWORK OF GROUND DATA SENSORS: A USER-ORIENTED EXPERIMENT,
Geological Survey, St. Louis, Mo. EROS Program.
Jaems F. Daniel.
Preprint No. 29, Paper presented at National Symposium on Data and Instrumentation for Water Quality Management, Madison, Wisconsin Univ, July 1970. 13 p, 1 fig, 3 tab, 6 ref.

Descriptors: *Satellities (Artificial), *Networks, *Data collections, *Remote sensing, Geology, Hydrology, Water resources, Meteorological data, Meteorology, Hydrologic data.
Identifiers: ERTS.

The intent of providing ground sensor data concurrently with and in the interim of successive image sets from the ERTS-A satellite is to improve the qualitative, semi-quantitative and quantitative interpretations of that imagery. A network of a relatively small number of stations with maximum areal application to provide that data has been designed and sites have been selected. Important to that network are hydrologic sensors as they relate to visual interpretation of imagery and management of water resources. A localized network of sensors to test real-time applications of satellite relayed data will have water quality sensors as a basic ingredient. (Knapp-USGS)
W71-01772

THE SIMULATION OF THE MOVEMENT OF AN INTERFACE BETWEEM SALT AND FRESH WATERS IN A COASTAL AQUIFER BY THE AID OF AN RC ANALOG,
Technion - Israel Inst. of Tech., Haifa. Dept. of Civil Engineering.
G. Dagan.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 111-119, 1969. 9 p, 9 fig, 3 ref.

Descriptors: *Analog models, *Resistance networks, *Saline water-freshwater interfaces, Model studies, Groundwater movement, Simulation analysis, Flow, Porous media.
Identifiers: *Coastal aquifers.

Resistance-capacitance (RC) networks are usually used to simulate the linearized equations of groundwater flow in unconfined aquifers. A similar linerization gives a system of two equations for the flow of fresh and salt waters, separated by an interface, in coastal aquifers. A double resistance network connected by capacitors is proposed to model this system. The voltage difference between the two subnetworks is proportional to the interface elevation. Other different types of analog networks are reviewed. (Knapp-USGS)
W71-01941

7B. Data Acquisition

STOCK ASSESSMENT BY ECHO INTEGRATION AND ITS APPLICATION TO JUVENILE SOCKEYE SALMON IN LAKE WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 02H.
W71-01678

SOME RULES USED FOR THE OBSERVATION OF CONCRETE DAMS,
Consulpresa S. A., Madrid (Spain).
For primary bibliographic entry see Field 08A.
W71-01722

FAST-RESPONSE EQUIPMENT FOR ACOUSTIC LOGGING,
For primary bibliographic entry see Field 08E.
W71-01725

SATELLITE (ERTS-A) NETWORK OF GROUND DATA SENSORS: A USER-ORIENTED EXPERIMENT,
Geological Survey, St. Louis, Mo. EROS Program.
For primary bibliographic entry see Field 07A.
W71-01772

A CONDUCTIVITY BRIDGE FOR THE MEASUREMENT OF SALINITY OF SEA WATER,
Woods Hole Oceanographic Institution, Mass.
Alvin L. Bradshaw, and Karl E. Schleicher.
Available from NTIS as AD-699 901, $3.00 in paper copy, $0.95 microfiche. Technical report, No. WHOI-REF-56-20, Mar 1956. 66 p, 17 fig, 14 ref. Bu Ships Contract NObsr-43270.
Identifiers: *Salinometers, Design, Operation, Electrical conductance, Fixed resistors, Capacitors, Wiring diagrams, Impedance bridges, Salinity, Measurement, Sea water.

A sea-going conductivity bridge (Salinometer) for measuring the salinity of sea water is described in considerable detail. In principle, the salinity of an unknown sample is determined by comparing its conductivity with that of a sample of known salinity at the same temperature. The calibration of the bridge is found empirically. The instrument consists of a constant temperature bath, a 1000 cycle impedance bridge using glass conductivity cells in two of its arms, a phase detector to convert the 1000 cycles output of the bridge to DC and a balancing mechanism to complete automatically the fine adjustment in bridge balance. It operates from a a 110 v60 cycle power source.
W71-01877

DIVISION OF ISOTOPES DEVELOPMENT RESEARCH AND DEVELOPMENT PROJECTS: 1969.
Division of Isotopes Development (AEC), Washington, D.C.

For primary bibliographic entry see Field 05A.
W71-01881

CRITERIA FOR RECOGNITION OF ESTUARINE WATER POLLUTION BY AERIAL REMOTE SENSING,
Rhode Island Univ., Kingston. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W71-01900

SPATIAL SPECTRA OF OCEAN SURFACE TEMPERATURE,
National Oceanic and Atmospheric Administration, Miami, Fla. Sea-Air Interaction Lab.
For primary bibliographic entry see Field 02K.
W71-01907

7C. Evaluation, Processing and Publication

USE OF NEW ANALYTICAL METHODS FOR WATER RESOURCE DEVELOPMENT,
Texas Univ., Austin. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 06A.
W71-01658

MATHEMATICAL PROGRAMMING FOR REGIONAL WATER QUALITY MANAGEMENT,
California Univ., Los Angeles. Graduate School of Business Administration.
For primary bibliographic entry see Field 05G.
W71-01659

DIGITAL COMPUTER CALCULATION OF UNSTEADY OPEN-CHANNEL FLOW (FRENCH),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 08B.
W71-01800

SIMULATION OF FLOOD PROPAGATION BY DIGITAL COMPUTER AND ITS APPLICATION TO RIVER PROBLEM,
Central Research Inst. of Electric Power Industry, Tokyo, (Japan).
For primary bibliographic entry see Field 08B.
W71-01802

DIGITAL SIMULATION IN HYDROLOGY AND ITS ROLE IN HYDROLOGIC EDUCATION,
Stanford Univ., Calif. Dept. of Civil Engineering.
Ray K. Linsley.
In: The Progress of Hydrology, Vol 2 - Specialized Hydrologic Subjects, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 563-571, published by Univ. of Illinois, 1969. 9 p, 1 fig, 7 ref.

Descriptors: *International Hydrological Decade, Conferences, *Simulation analysis, *Synthetic hydrology, *Computer programs, Reviews, Routing, Rainfall-runoff relationships, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Education, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, Stanford Watershed Model.

Simulation models of river basin hydrology are briefly reviewed. Simulation models employ functions which are chosen with a view to describing the hydrologic process with reasonable accuracy and yet are susceptible to rapid solution on the digital computer. Development of the Stanford Watershed Model has had a significant impact on hydrologic education at Stanford. The contributions of SWM to hydrologic education at Stanford have occurred in a number of ways. Basically these may be grouped under three headings: organizing instruction around the flow diagram of the Stanford Watershed Model as a basic functional description of the hydrologic cycle; providing greater opportunity for students to explore hydrologic processes via digital simulation; and providing a base for a variety of research projects in hydrology. In addition to its use as a basis of discussion, the SWM permits rapid determination of the effects of various factors on the hydrologic process. Starting from some reference conditions one may investigate the effect of altering rainfall amount or intensity, antecedent soil moisture, potential evaporation, number of precipitation stations, changes in land use, changes in channel conditions and many other factors. The consequences of such changes on the streamflow hydrograph, soil moisture, actual evapotranspiration or suspended sediment outflow may be determined for a single storm or during a month or year. If snow is involved, the effect of altering wind, dewpoint, insolation or initial snowpack on patterns of snowmelt or streamflow may be evaluated. (Knapp-USGS)
W71-01820

HYDROLOGIC DATA REDUCTION TECHNIQUES AND UNIT CONVERSIONS FOR USE IN THE OGRE, T-WAVE, FLIP, AND RAVE FLUID FLOW CODES,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 02F.
W71-01887

A PROCEDURE FOR COMPUTING AND DISPLAYING TIME VARYING POWER SPECTRA ILLUSTRATED BY APPLICATION TO A GEOPHYSICAL PROCESS,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
Donald G. Wilson.
Chesapeake Bay Institute Technical Report 67, Reference 70-7, Johns Hopkins University, August 1970. 37 p, 15 fig, 7 ref. ONR Research Prog NR 083-016, Contract N00014-67-A-0163-0006.

Descriptors: *Time series analysis, *Statistical methods, *Spectroscopy, Geophysics, Ocean waves, Digital computers, Water pressure, Remote sensing, Mathematical models, Equations, Data processing, Statistics, Data storage and retrieval, Telemetry, Data transmission.
Identifiers: Computer graphics.

Computing time-dependent power spectra is an important method for studying non-stationarities in signals. An efficient procedure for computing such spectra and displaying them immediately is requisite for effective application. The method presented is based on a data window which moves along the signal in unit increments. The spectrum is updated for each new sample. All spectra are displayed on a computer graphic terminal and the algorithm was deliberately constructed to make computer graphic display efficient. (Woodard-USGS)
W71-01910

SEAMAP DEEP-SEA CHANNEL,
Pacific Oceanographic Lab., Seattle, Wash.
Paul J. Grim.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $0.35. Environmental Science Services Administration (ESSA) Report ERL 93-POL 2, January 1969. 27 p, 9 fig, 21 ref.

Descriptors: *Sedimentation, *Erosion, *Channel erosion, *Turbidity currents, *Ocean currents, Channel flow, Ocean circulation, Turbidity, Sediments, Channel morphology, Graduation, Profiles, Contiental slope, Marine geology, Littoral drift, Sediment transport, Alaska, Pacific Ocean.
Identifiers: Abyss, Aleutian trench, Axial profile, Graphs, Tectonic activity (Aleutians).

The SEAMAP deep-sea channel is a relic feature on the Aleutian abyssal plain south of the Aleutian trench. Along most of its 370-km length it has well-developed levees that are generally asymmetrical and differ in height. Typically the channel is about 50 m in depth and/6km in width. From its northern end on the south wall of the Aleutian trench the channel floor rises towards the southwest from a depth of 4800 m to a minimum depth of 4590 m near its midpoint. Continuing in the same direction it deepens again to 4750 m. This gradient reversal precludes turbidity currents from flowing through the channel and supports the thesis that the Aleutian abyssal plain is a relic feature that has been cut off from its supply of turbidite material by the downbowing of the Aleutian trench. The channel apparently has been destroyed by slumping on the south wall of the trench north of the 4800-m countour. For much of its length, it is subparallel to the trench and from a topographic standpoint occupies the crest of the outer ridge south of the trench. (Woodard-USGS)
W71-01919

THE ENCROACHMENT OF THE SALT WATER IN KOITO RIVER MOUTH RESERVOIR,
Chiba Prefecture Industrial Water Dept. (Japan); and Mitsui Consultants Co., Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 02L.
W71-01942

08. ENGINEERING WORKS

8A. Structures

RELATIVE EFFECT OF WAVES GENERATED BY LARGE SHIPS AND SMALL BOATS IN RESTRICTED WATERWAYS,
California Univ., Berkeley, Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01664

GEISERT V CHICAGO R I AND P RY (SERVIENT LANDS MUST SUFFER CONSEQUENCES OF UNRESTRAINED FLOW OF DRAINAGE FROM DOMINANT ESTATES).
For primary bibliographic entry see Field 06E.
W71-01674

SOME RULES USED FOR THE OBSERVATION OF CONCRETE DAMS,
Consulpresa S. A., Madrid (Spain).
J. L. Serafim, and M. Guerreiro.
Water Power, Vol 22, No 5/6, p 181-189, May-June, 1970. 9 p, 7 fig, 1 tab, 11 ref.

Descriptors: Dams, *Concrete dams, *Performance, Instrumentation, Data collections, Structural behavior, Safety, Inspection, Foreign countries, Operation and maintenance, Control systems, Displacements, Deformation, Seepage, Settlement (Structural), Measuring instruments, Measurement, Behavior, Uplift pressure.
Identifiers: Procedures, Reports, Spain.

Experience gained in observing the performance of concrete dams in Spain over a 5-yr period is described. Typical cases presented are: (1) existing dams with and without observation systems; (2) control of the behavior of dams from the first total loading; and (3) observations of dams instrumented by a department organized for such work. Procedures followed in each case are indicated, special attention being given to the organization of the observation work, inspection of the dam, and study of special problems and their consequences at the time of first loading. Observation methods and a procedure to simplify and reduce the work of calculations and diagrams are indicated. Present observation techniques make possible the behavior control of any dam not having an observation system, regardless of age or type. Recommended procedure for establishing the observation of a dam is: (1) assemble relevant design and construction documents; (2) inspect the dam; (3) report on the

type of observation system to be installed; (4) elaborate the observation plan; and (5) install the apparatus and fulfill the program of readings and measurements. (USBR)
W71-01722

CONCRETE PLACEMENT (SPLIT LEVEL - NO VERTICAL JOINT SCHEME),
For primary bibliographic entry see Field 08F.
W71-01723

MANAPOURI POWER PROJECT: TAILRACE TUNNEL CONSTRUCTION,
Bechtel Pacific Corp. Ltd., Bluff (New Zealand).
S. E. Brooks.
N Z Eng, Vol 25, No 5, p 120-124, May 1970. 5 p, 2 fig.

Descriptors: *Tailrace, *Tunnels, Tunnel linings, Surge tanks, *Tunnel construction, Tunnel design, Rock bolts, Alinements, Foreign construction, Compressed air, Ventilation, Dewatering, Construction, Tunneling, Construction equipment.
Identifiers: Manapouri Project, New Zealand, Blasting, Construction methods, Tunnel supports.

The Manapouri turbines discharge to the sea through a 6-1/4-mi-long tailrace tunnel that is a concrete-lined, 30-ft-dia horseshoe section with a flat invert. A surge chamber and shaft accommodate any surge action. Tunnel design, preliminary construction work, excavation methods, drainage and pumping problems, blasting and mucking procedures, and tunnel lining operations are described. Preliminary on-shore work started at Deep Cove, New Zealand, in Sept 1963, with the first shot being fired in Feb 1964, and the tunnel ready for service at the end of Aug 1969. Seven major fault zones were encountered in the tunnels length. (USBR)
W71-01734

THE CLYWEDOG RESERVOIR PROJECT,
Halcrow (William) And Partners, London (England).
A. E. Fordham.
J Inst Water Eng, Vol 24, No 1, p 17-76, Feb 1970. 63 p, 21 fig, 1 tab, 13 ref, 3 append, 15 disc.

Descriptors: Dams, Contrete dams, *Buttress dams, Dam foundations, *Dam construction, Preliminary investigations, *Dam design, Concrete placing, Design criteria, River basin development, Water resources development, Foreign construction, Project planning, Construction, Concrete control, Scheduling, Planning, Design flood.
Identifiers: Great Britain, *Clywedog Dam, Great Britain, Construction control, Construction methods.

Clywedog Dam is a 220-ft-high, 730-ft-long concrete buttress dam located on the Clywedog River in Great Britain. The history and description of the project from initial planning to the first filling of the reservoir are presented. The basic aims of the structural design of the dam were: (1) the effective slenderness ratio of buttresses should not exceed about 10; (2) based on conventional linear analysis, maximum principal compressive stress should not exceed 490 lb/sq in. and there should be no tension; (3) the ratio of horizontal thrust from the water to the weight of a buttress should not exceed 0.85 at the foundation; and (4) loads on the foundation should not exceed 18 tons/sq ft. Linear analysis was checked by a more eleborate finite element analysis which was shown to be advisable by readings of stress and strain gages installed during construction. Construction planning, procedures, and control are described. The bulk of concrete in the dam was placed by a 10-ton cableway equipped with a fixed-head mast and a tail carriage that traveled along a track long enough for the burden rope to cover the entire dam area. Concrete was specified by strength, and few problems were encountered with temperature control using ordinary portland cement. (USBR)
W71-01738

TECHNOLOGY OF CONSTRUCTING CANALS WITH POLYMER MEMBRANE LININGS,
For primary bibliographic entry see Field 08G.
W71-01739

LOUISVILLE AND N RR V SALTZER (RAILROAD'S LIABILITY FOR BANK EROSION CAUSED BY REROUTING OF RIVER).
For primary bibliographic entry see Field 06E.
W71-01744

HEARINGS AND REPORT ON AMENDMENT TO THE WATERSHED AND FLOOD PREVENTION ACT BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONG, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01751

GLORE V HAGGARD (IMPLIED EASEMENT TO MAINTAIN PIPELINE FOR EXERCISE OF WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-01753

TWIN FALLS CANAL CO V AMERICAN FALLS RESERVOIR DIST NO 2 (DIVERSION OF UNAPPROPRIATED WATER).
For primary bibliographic entry see Field 06E.
W71-01861

RUMANIAN IRRIGATION.

Engineering News Record, Vol 185, No 23, p 13, December 3, 1970. 1 p.

Descriptors: *Irrigation systems, *Irrigation engineering, *Hydraulic design, Economics, Operation and maintenance, Canals, Pipes, Automatic control, Penstocks.
Identifiers: Rumania, Danube Plain.

A $52 million irrigation system under construction in Rumania's Danube Plain, southwest of Bucharest, will ultimately provide water to 200,000 acres. Crop output could be more than doubled by the system. London-based consultants say water will be pumped from the Danube River into an unlined canal that crosses the floodplain. An automatic main pumping station with 8 pumps will force water at 1,530 cfs up a 3-mile long steel penstock with a static lift of 232 ft. The water will flow in lined gravity canals 5 miles to a second pumping station where 5 pumps will lift the water 85 ft through a 2-mile long penstock into the final distribution level. The system will be automated for maintaining constant volume, and 156 secondary pumping stations located throughout the system will help monitor the flow of water. In the event of power failure or too much water in any part of the works, wiers will close automatically to reduce or stop the flow. (Lang-USGS)
W71-01905

DE KALB COUNTY V TENN ELEC POWER CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM OVERFLOW DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-01965

A PRELIMINARY STUDY OF THE COST OF TUNNEL CONSTRUCTION,
Road Research Lab., Crowthorne (England).
G. Margason, and R. G. Pocock.
Available from NTIS as PB-194 133, $3.00 in paper copy, $0.95 in microfiche. RRL Report LR 326, 1970. 5 tab, 49 ref.

Descriptors:
Identifiers: *Vehicular tunnels, Construction costs, Tunneling, Excavation, Soils, Tunnel linings, Great Britain.

A preliminary study has been made to obtain information on the broad breakdown of the price of driven-tunnel construction. Only the direct engineering prices of construction are discussed and no consideration is given to any indirect costs or benefits associated with sub-surface roads.
W71-02053

SPECIAL REPORT: COOLING TOWERS.
For primary bibliographic entry see Field 05D.
W71-02064

CITY OF COVINGTON V STATE TAX COMM'N (ASSESSMENT OF SUBMERGED LAND FOR TAXING PURPOSES).
For primary bibliographic entry see Field 06E.
W71-02127

8B. Hydraulics

A MULTIVARIATE STATISTICAL MODEL FOR ESTIMATING THE NUMBERS, SIZES,AND INTERFLUVIAL DISTANCES OF STREAMS WITHIN A RELATIVELY HOMOGENEOUS DRAINAGE AREA.
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 02E.
W71-01662

RELATIVE EFFECT OF WAVES GENERATED BY LARGE SHIPS AND SMALL BOATS IN RESTRICTED WATERWAYS,
California Univ., Berkeley, Hydraulic Engineering Lab.
M. M. Das.
Available from NTIS as AD-704 298, $3.00 in paper copy, $0.95 in microfiche. Report No. HEL-12-9, November 1969. 41 p, 6 tab, 64 fig, 64 ref. Army DACW72-68-C-0034.
Identifiers: *Ships, *Water waves, *Boats, Water waves, Hydrodynamics, Insland waterways, Harbors, Erosion, Piers, Floating docks, Cargo ships, Energy, Velocity.

The peak wave energy in a system of waves resulting from the passage of a ship is important in engineering problems such as bank erosion, the motion of moored vessels, and forces on fixed and floating docks. With respect to bank erosion, the question often asked is whether the single passage of a large ship is more damaging than numerous passages of small pleasure craft. The study was conducted to determine the relative importance of the peak energy resulting from the passage of a cargo ship and a pleasure cruiser. The characteristics of the waves generated by these vessels moving at various speeds in deep and shallow water were determined from model studies. A numerical example is given in which prototype values of peak wave energy were predicted from the model data, and then ratios of the peak energies computed. The importance of ship speed is evident in these comparisons.
W71-01664

DETRIMENTAL EFFECTS OF NATURAL SOIL AND WATER ELEMENTS ON DRAINAGE PIPE STRUCTURES IN ALABAMA,
Geological Survey, Tuscaloosa, Ala. Water Resources Div.
Luther W. Hyde, Victor M. Shamburger, Jesse S. Ellard, and Rubin E. Pate.
Available from NTIS as PB-189 373, $3.00 in paper copy, $0.95 in microfiche. Alabama Highway Research Report No. HPR-40, 1969. 152 p, 7 tab, 80 ref, 35 fig.
Identifiers: *Roads, Surface properties, *Skidding, Test equipment, *Trailers, Design, Friction, Towing vehicles. Water, Vibration, Velocity, Recording

systems, Control panels, Power, Calibration, Bituminous coatings, Asphalt, Concrete, Louisiana, Evaluation Skid numbers, *Skid resistance.

Field studies were conducted in Alabama on soil and water parameters to determine their relationship to culvert pipe corrosion. The types of culvert materials, investigated included concrete, galvanized steel, bituminous-coated galvanized steel, aluminum, bituminous-coated aluminum, pitch-impregnated fiber, cast iron, and vitrified clay. Water parameters measured included pH, oxidation-reduction potential, dissolved oxygen, resistivity, etc. Soil parameters determined were pH, oxidation-reduction potential, resistivity, and geologic conditions. Soil parameters generally were less significant than water parameters in the corrosion of culverts. A graphical method based on pH, resistivity, and dissolved oxygen content of water was devised for estimating life expectancy of steel pipe. Galvanized pipe is not recommended for use in run-off water of low resistivity, low pH or high dissolved oxygen content unless effectively coated with bituminous material. Aluminum pipe was found to be less affected by acidic waters than galvanized steel but less resistant to abrasion effects. With the exception of areas affected by acid mine drainage, concrete pipe was highly resistant to corrosion. Pitch-fiber pipe as well as corrugated cast iron and vitrified clay performed exceptionally well.
W71-01676

HYDRAULIC MODEL STUDIES OF SILVER JACK DAM SPILLWAY STILLING BASIN, BOSTWICK PARK PROJECT, COLORADO,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
T. J. Rhone.
Available from NTIS as PB-190 279, $3.00 in paper copy, $0.95 in microfiche. REC-OCE-70-3, January 1970. 22 p, 11 fig, 2 ref.
Identifiers: Silver Jack Dam, Bostwick Park (Colorado), *Stilling basins, *Spillways, *Dams, Hydraulic models, Colorado, Design, Model tests, Pipes, Baffles.

A massive landslide destroyed the nearly completed spillway stilling basin at Silver Jack Dam in Colorado. A circular curve in an inclined plane was used to connect the undamaged approach conduit and the relocated stilling basin. Hydraulic model studies were performed to assure satisfactory flow conditions in the conduit and stilling basin under limited tailwater conditions and with unsymetrical approach flow resulting from a circular curve in the upstream conduit. A deflector vane was installed in the crown of the tunnel downstream from the curve to prevent the flow from crossing over the top and sealing the portal. Vanes were developed for the stilling basin approach chute to improve flow distribution in the basin. Unique daffle blocks were developed to provide good energy distribution in a basin that had insufficient tailwater depth to form a conventional hydraulic jump. Pressure measurements were made on the conduit bend, conduit vane, chute vanes, and baffle blocks.
W71-01694

OPEN CHANNEL EXPANSIONS FITTED WITH LOCAL HUMP,
Sir George Williams Univ., Montreal (Quebec); And Indian Inst. of Science, Bangalore.
A. S. Ramamurthy, S. Basak, and P. R. Rao.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY5, p 1105-1113, May 1970. 9 p, 6 fig, 1 tab, 7 ref, 2 append.

Descriptors: Channels, Channel erosion, Channel flow, Reynolds number, *Flow separation, *Expansion, Open channel flow, Hydraulics, Subcritical flow, Fluid mechanics, Transition flow, *Transitions (Structures), *Open channels, Deceleration, Velocity distribution, Laboratory tests, Erosion control, Flow control, Eddies, Roughness (Hydraulic).
Identifiers: Eddy currents.

Flow in channel expansions tends to separate while subjected to the adverse pressure gradient associated with flow deceleration. Flow separation causes eddying and erosive attack on the downstream channel. Tests show that a local hump set in the bottom profile of an expansion decreases the incidence of flow separation and diminishes erosive action. The specific energy diagram is used to describe the action of the hump. Sectional views of normalized velocity contours for a test flume with and without humps at several values of Reynolds number are presented. Plan views of normalized velocity distribution curves for the test flume with and without humps are presented for large Reynolds numbers. (USBR)
W71-01731

PRESSURE SURGE ATTENUATION UTILIZING AN AIR CHAMBER,
Kentucky Univ., Lexington.
D. J. Wood.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY5, p 1143-1156, May 1970. 14 p, 10 fig, 10 ref, 2 append.

Descriptors: Water hammer, Hydraulics, *Surges, *Unsteady flow, Fluid mechanics, Oscillation, Pulsating flow, *Air chambers, *Attenuation, Analysis, Performance tests, Pipelines, Pipe flow, Closed conduit flow, Analytical techniques.
Identifiers: Wave propagation, Transient flow, Pressure waves, Surge waves, Pipeline surges.

The effect of a single air chamber on the propagation of a pressure surge in a line is investigated. The pressure surge is generated by rapid closure of a downstream value. A distributed parameter wave analysis and a lumped parameter slug flow analysis are formulated to describe the transient flow situation. Short-term effects are not predicted by a lumped parameter analysis, but are important; the magnitude of the short-term surge may be many times greater than that predicted by a lumped parameter analysis. The optimum design of an air chamber is possible, and is dependent on short-term effects. Experimental results were in close agreement with those predicted. The performance of an air chamber must be evaluated relative to a specific application; an accurate transient analysis is necessary and can be accomplished using the approach described. (USBR)
W71-01732

SURGE AND AIR ENTRAINMENT IN PIPELINES,
Bureau of Reclamation, Denver, Colo.
L. H. Burton, and D. F. Nelson.
Pap, Inst Contr Flow Closed Conduits, Colo State Univ, Aug 1970. 40 p, 25 fig, 9 ref.

Descriptors: *Air entrainment, *Surges, *Pipelines, Closed conduits, Closed conduit flow, Distribution systems, Fluid flow, Control, Vents, Upstream, Check structures, Oscillation, Air traps, Analysis, Control systems, Water conveyance.
Identifiers: *Coachella Distribution System, Calif, *Canadian River Project, Tex, Pipestands.

The Bureau of Reclamation has constructed 2 closed conduit water conveyance systems using upstream control. They are the Coachella Valley Distribution System in southern California and the Canadian River Project in northwestern Texas. Operational problems in the 2 systems, laboratory and field tests conducted before and after construction, and solutions adopted for surge and air entrainment problems during design and construction are reviewed. Problems in upstream control systems have been more severe than in downstream control systems. An upstream control system is feasible for economical reasons where the topography lends itself to such a system. Past experience and better tools for analysis will reduce the magnitude of future problems in upstream control systems. Future systems are discussed, including methods of analysis for surging and air entrainment, and types of strucutres that may be used. (USBR)
W71-01737

GAUGING AND SAMPLING INDUSTRIAL WASTE WATER (OPEN CHANNEL),
Department of Water Resources, New York. Bureau of Water Pollution Control.
For primary bibliographic entry see Field 05A.
W71-01757

PREDICTION OF ORIFICE DISCHARGE AND HEAD LOSS ALONG A SMALL DIAMETER TERMINAL PERFORATED PIPE,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
Frank H. Jones.
M. S. Thesis, New Mexico State University, March 1969. 45 p, 10 fig, 7 tab, 21 ref, 1 append. OWRR Project A-006-NMEX (2).

Descriptors: *Head loss, *Subsurface irrigations, *Plastic pipes, *Orifices, Irrigation water, Pipes, Orifice flow, Pipe flow, Darcy-Weisbach equation, Equations, Discharge coefficients.
Identifiers: Perforated pipes, Head loss prediction.

A prediction equation was developed to be used to predict the head loss occurring along a one-half inch perforated polyethelene plastic pipe, the leading type used in subsurface irrigation systems. An equation which was developed experimentally shows the head loss to be approximately 70% of that predicted by a measured value of the Darcy-Weisbach friction factor on a similar unperforated pipe. A prediction equation was also developed for orifice flow through the pipe perforations. Orifices were drilled with a thirty-thousandths of an inch diameter bit and the coefficient of discharge was found to be 0.612. It was found that with careful preparation, the Christiansen uniformity coefficient of ninety to ninety-five percent could be obtained for orifices under the same head. (Knapp-USGS)
W71-01776

SOME MORPHOMETRICAL RELATIONSHIPS IN THE MIDDLE AND LOWER REACHES OF THE AMU DARYA,
Sredneazuatsjuu Bauchno-Issledovatelskii Institut Irrigatsii, Tashkent (USSR).
A. M. Mukhamedov, and H. A. Ismaghilov.
In: Proceedings 13 th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 191-194, 1969. 4 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Channel morphology, *Alluvial channels, Rivers, Sediment transport, Bed load, Sediment load, Suspended load, Scour, Erosion, Discharge (Water), Sediment discharge.
Identifiers: Amu Darya River (USSR).

The Amu Darya is the largest river of Central Asia. Flood discharges of the Amu Darya River vary from 5,000 to 10,000 cu m/sec. Low water discharges vary from 200 to 300 cu m/sec. The difference between the flood level and the low water level amounts to 2.5 to 3 m. The river carries a very large amount of suspended sediments and bedload. Long-term mean density of suspended sediment in the lower reaches is 2.56 kg/cu m, while the highest density of suspended sediment is as high as 13 kg/cu m. The channel is in a state of continuous change due to a steep slope (0.00015-0.00035), high velocities of the flow (up to 2.5 to 3.5 m/sec.), instability of the hydrograph throughout the year, and especially during the high water period, and an extreme instability of the channel, which is formed of erodible fine sands of 0.10 to 0.0 mm diameter. (Knapp-USGS)
W71-01779

MORPHOLOGICAL PRINCIPLE OF MODELLING RIVER-BED PROCESS,
State Hydrological Inst., Leningrad (USSR).
N. S. Snamenskaya.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars),

Science Council of Japan, Kyoto, p 195-200, 1969. 6 p, 2 fig, 3 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Sediment transport, Alluvial channels, Model studies, Sands, Density, Discharge (Water), Sediment discharge, Sedimentary structures.
Identifiers: Movable-bed models.

To study problems of river bed deformation on rivers with structures of economic importance, it is often necessary to use movable-bed models. Techniques developed for the study of stream hydraulics on rigid models cannot be applied easily to movable-bed models. For good scaling, sand must be replaced by lighter material or water discharge must be increased relative to that estimated by F number, which depends to some degree on intuition. The type of substitute affects the shape of dunes and the rate of sediment transport; therefore it is not easy to choose what substitute to use. Methods of calculating sediment density and water discharge relationships for the best scale factors are briefly discussed. (Knapp-USGS)
W71-01780

A BASIC CAUSE OF A BRAIDED CHANNEL,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01781

SIMULATION OF RIVER BED VARIATION IN MOUNTAINOUS BASIN,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01782

ON THE GEOMETRICAL CHARACTERISTICS OF SAND WAVES,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yuichiro Tanaka.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 249-255, 1969. 7 p, 6 fig, 7 ref.

Descriptors: *Sand waves, *Meanders, *Sediment transport, *Bed load, *Uniform flow, Sands, Turbulent flow, Regime, Hydraulic models, Alluvial channels, Open channel flow, Channel morphology.
Identifiers: Japan, Transverse water-surface oscillations.

A mathematical analysis was made of the length and height of sand waves formed on a movable bed in open channels under the condition of uniform flow. The mean length of alternating bars in straight channels and the meander length of meandering streams are related to the flow parameters using the oncept of transverse oscillations of the water surface. The height of sand waves in the equilibrium state for the low flow regime is determined by the flow parameters using the shallow-water approximation for the fluid and the continuity equation for sediment transport. The theory seems to give a reasonable explanation of the variation of the height of sand waves with the flow conditions. These analytical results are compared with experimental data obtained from measurements in experimental flumes and in rivers, with generally good agreement. (Knapp-USGS)
W71-01783

ON THE MEAN VELOCITY FORMULAS OF RIVERS,
Tokushima Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01784

CHANGES OF TOP-SET-BED IN A SILTED RESERVOIR,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01785

VARIATION OF ROUGHNESS DURING DEGRADATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. W. Shen, and B. Suryanarayana.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-1 (Seminars), Science Council of Japan, Kyoto, p 277-280, 1969. 4 p, 1 fig, 2 ref. NSF Research Grant GK-0549.

Descriptors: *Roughness (Hydraulic), *Variability, *Stream erosion, *Degradation (Stream), Sediment transport, Model studies, Flumes, Sediments, Particle size, Particle shape, Equations.

The variation of roughness during a degradation study in a laboratory flume was found to be the same as that of the equilibrium flow. During degradation, the form resistance increased for sand finer than 0.6 mm and decreased for sand coarser than 0.6 mm. At the end of degradation, Shield's criterion for incipient motion was valid for sand coarser than 0.6 mm when the bed was plane and it was not valid for sand finer than 0.6 mm when the bed was rippled. (Woodard-USGS)
W71-01786

PROBLEMS OF TWO-PHASE FLOW THEORY,
Novosibirsk State Univ. (USSR).
Oleg F. Vasiliev.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 5-3 (General Lectures, Records of Congress, Social Events and Study Tours), Science Council of Japan, Kyoto, p 39-84, 1969. 46 p, 94 ref.

Descriptors: *Sediment transport, *Open channel flow, *Rheology, *Hydrodynamics, *Theoretical analysis, Reviews, Mathematical studies, Equations, Erosion, Runoff, Streamflow, Turbulent flow, Flow rates, Sediment load, Suspended load, Sediment distribution, Settling velocity, Gravity, Sedimentation, Particle size, Diffusion, Fluid mechanics, Viscosity, Foreign projects.
Identifiers: *USSR, *International Association for Hydraulic Research.

A review of hydrodynamic theories of sediment transport in open-channel flow is presented from material developed primarily from research that has been done in the Soviet Union. Methods of deriving equations related to two-phase flow are described. In the thirties the turbulent diffusion theory was developed in application to the movement of suspended load in open channels, first by V.M. Makkaveyev (1931) and M.P. O'Brien (USA,1933), and later was published on by others. The chief shortcoming of the theory is that it considers suspended particles as a passive substance which, is carried by, but exerts no dynamic response on the flow of the transporting fluid. Significant progress in establishment of a theory of turbulent multicomponent flows came about in the fifties with publication by F. I. Frankle's theory and work by others. (Woodard-USGS)
W71-01789

DIFFUSION OF HORIZONTAL BUOYANT JET DISCHARGED AT WATER SURFACE,
Tokyo Univ. (Japan).
For primary bibliographic entry see Field 05B.
W71-01790

DEEPENING THE APPROACH CHANNEL TO THE PORT OF COCHIN, INDIA,
Central Water and Power Research Station, Poona (India). Tidal Hydraulics Div.
C. V. Gole, and P. P. Vaidyaraman.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 233-240 1969. 8 p, 3 fig.

Descriptors: *Harbors, *Silting, *Saline water intrusion, Mixing, Sedimentation, Stratified flow, Density currents, Saline water-freshwater interfaces, Dredging, Channel improvement, Desilting, Hydraulic models, Model studies.
Identifiers: Cochin (India).

The Port of Cochin, on the west coast of India has an approach channel 21,000 ft. long and 450 ft. wide, which is maintained to a depth of -32 ft. In order to accommodate super tankers, it is proposed to deepen the channel to -45 ft. and widen it to 600 ft. Because the flood discharges of the various rivers find their way into the sea through the harbor area, strong density effects result from mixing tidal and fresh water flows. The formation of a salt water wedge is responsible for the high rate of siltation at Cochin. The effects of deepening and widening the channel were studied in a saline water model with a fresh water discharge of 66,000 cfs. As a result of the proposed deepening, the salt water wedge would move upstream and there would be an increase in the quantity of maintenance dredging. (Knapp-USGS)
W71-01792

HYDRAULIC AND SEDIMENTARY PROBLEMS IN TIDAL ESTUARIES,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
For primary bibliographic entry see Field 02L.
W71-01795

STUDY OF THE INFLUENCE OF A DAM, BUILT IN A TIDAL ESTUARY, ON ITS TIDAL CHARACTERISTICS,
Laboratorio Nacional de Engenharia Civil, Lisbon (Portugal).
Fernando M. Abecasis, and Ildeberto B. Mota Oliveira.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 283-291, 1969. 9 p, 3 fig, 4 ref.

Descriptors: *Tidal effects, *Estuaries, *Currents (Water), Water circulation, Sediment transport, Scour, Sedimentation, Dams, Streamflow, Regime, Hydroelectric plants, Hydroelectric power, Tailwater, Mathematical models.
Identifiers: Douro River (Portugal).

The construction of a dam 20 Km upstream of the mouth of the Douro river, near Oport city in Portugal will sensibly affect the tidal regime of its estuary, resulting as the most noticeable consequence, in a diminished natural flushing ability of the tidal currents. Tidal propagation in the estuary was studied by a finite-difference method. The natural flushing ability of the mouth of the river during dry season, for a spring tide, with a constant turbine discharge, is of the order of 50% of that corresponding to the natural river regime. This value falls to 20% when the turbine discharge is concentrated in a four hour period during low-water. Flushing increases to 120% when the discharge period is centered over mid-ebb. (Knapp-USGS)
W71-01797

MATHEMATICAL SIMULATION OF TWO-DIMENSIONAL HORIZONTAL CONVECTIVE-DISPERSION IN WELL-MIXED ESTUARIES,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01798

FLUME STUDY ON SALINITY INTRUSION IN ESTUARIES,
Waterloopkindig Laboratorium, Delft (Netherlands).

For primary bibliographic entry see Field 02L.
W71-01799

DIGITAL COMPUTER CALCULATION OF UNSTEADY OPEN-CHANNEL FLOW (FRENCH),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
Andre Chervet, and Pierre Dalleves.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 259-266, 1969. 8 p, 6 fig, 6 ref.

Descriptors: *Computer programs, *Unsteady flow, *Open channel flow, *Flood forecasting, *Waves (Water), Discharge (Water), Model studies, Surf, Bores, Hydrographs, Surges.
Identifiers: Method of characteristics.

An example is given of the use of digital computers in the numerical treatment of unsteady flow in open channels. A computer program was written at the Swiss Federal Laboratory for Hydraulic Research to calcuiate the flood resulting from the sudden release of storage water. It also calculates the propagation of long waves on a beach. The computation is carried out by the method of characteristics. The program calculates the path of the wave-front, the flooded areas, water levels, and discharge at any time and distance. In order to determine the limits of validity for the computing method, a comparison between the results of computation and model studies was made for the sudden release of storage water in an extremely steep and irregular alpine valley. The results of computation are in good agreement with the measured values. (Knapp-USGS)
W71-01800

ON THE SIMULATION OF RIVER-BED VARIATION BY CHARACTERISTICS,
Public Works Research Inst., Tokyo (Japan).
Kyozo Suga.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1, (Subject A), Science Council of Japan, Kyoto, p 289-296, 1969. 8 p, 4 fig, 2 ref.

Descriptors: *Unsteady flow, *Streamflow forecasting, *Mathematical studies, *Open channel flow, Waves (Water), Surges, Channel morphology, River beds.
Identifiers: Method of characteristics.

The characteristics method was applied to river-bed analysis for the cases of unsteady flow in rectangular channels and steady flow in compound channels. In normal calculation of river-bed variation, water current is often treated as steady flow with sufficient precision, even when flood waves and tidal levels are considered. However, when release of stored water is the source of unsteadiness, as in collapse of dams or the break of estuary sandy areas, no simplifications in basic equations are desirable. (Knapp-USGS)
W71-01801

SIMULATION OF FLOOD PROPAGATION BY DIGITAL COMPUTER AND ITS APPLICATION TO RIVER PROBLEM,
Central Research Inst. of Electric Power Industry, Tokyo, (Japan).
Shinobu Koreeda, and Tamotsu Akimoto.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 525-532, 1969. 8 p, 10 fig.

Descriptors: *Simulation analysis, *Floods, *Unsteady flow, Bores, Surges, Waves (Water), Digital computers, Mathematical models, Computer programs, Hydraulic models, Routing Channel morphology, Profiles, Stage-discharge relations, Flood routing.
Identifiers: Flood propagation.

Unsteady flow in river and channels may be analyzed by digital computer, taking account of various conditions of channel shape and flow. The method is based on the characteristics equations and combines the analysis of hydraulic bores and flow at varying sections in open channels. The simulation technique for calculation of flood propagation in a natural river is described, including methods of replacement of river shape, and the validity of this method is proved by comparison with results of experiments. (Knapp-USGS)
W71-01802

LAMINAR FLOW IN OPEN RECTANGULAR CHANNELS (A CONTRIBUTION TO THE FLOW PROBLEM OF OPEN CHANNELS),
H. Wagner.
Abstracts in French and German. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 43-51, 1969. 9 p, 5 fig.

Descriptors: *Open channel flow, *Laminar flow, *Equations, Mathematical studies, Streamflow, Stage-discharge relations, Velocity, Shear stress, Fluid friction.
Identifiers: Navier-Stokes equations.

Equations describing characteristics of laminar flow in open rectangular channels are based on the Navier-Stokes equations. For arbitrary width- to-depth ratios the exact function correlations of velocity distribution, flow, and shear stresses are developed. (Knapp-USGS)
W71-01803

SIMILITUDE OF MOBILE BED MODELS AND THE EFFECTS OF VARIATIONS ON THE LAWS OF SIMILITUDE (FRENCH),
Robert College, Istanbul (Turkey). Dept. of Hydraulics.
Fuat Senturk.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 321-335, 1969. 15 p, 3 fig, 4 ref.

Descriptors: *Hydraulic similitude, *Hydraulic models, Reynolds number, Froude number, Model studies, Sediment transport, Alluvial channels, Open channel flow.
Identifiers: Mobile bed models.

The problem of deviations from laws of similitude was studied. The deviation from Reynolds condition related to the grain size in the case of a river model causes a deviation from Froude's similitude also. (Knapp-USGS)
W71-01804

DETERMINATION OF COEFFICIENTS OF HYDRAULIC LOSS FOR UNSTEADY OPEN CHANNEL FLOW (FRENCH),
Technische Universitaet, Dresden (East Germany).
Marcel Bahler.
In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 181-188, 1969. 9 p, 2 fig, 2 tab.

Descriptors: *Unsteady flow, *Open channel flow, Mathematical studies, Equations, Head loss, Stage-discharge relations, Dam failure, Floods, Flood forecasting, Waves (Water), Surges, Simulation analysis, Model studies, Hydraulic models, Bores.
Identifiers: Unsteady open-channel flow.

In general, coefficients of hydraulic losses based on steady flow are used in the calculation of unsteady flow in open channels. This, theoretically as well as in practice, results in errors. In this paper a method is described for the determination of the coefficients of unsteady flow. Experiments which simulate the sudden and complete break of dams confirm the theoretical assumptions. (Knapp-USGS)
W71-01805

SIMULATION OF THE BAVARIAN REACH OF THE DANUBE RIVER,
Technische Hochschule, Munich (West Germany).
Wolfram Bauch.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 385-394, 1969. 10 p, 4 fig, 1 ref.

Descriptors: *Simulation analysis, *Mathematical models, *Flood routing, Streamflow forecasting, Water levels, Floods, Water management (Applied), River training, Navigation, Flood control.
Identifiers: Danube River.

The training works of the Bavarian part of the Danube River are planned to obtain better conditions for navigation. The necessary width and depth of the channel can only be achieved by means of banking. The result is an acceleration of the movement of flood waves. In order to know in advance the flood-conditions due to the training works, a mathematical model is used which simulates flood-wave-propagation. An example for application of the mathematical model is given in a 60 km reach of the river for the 1954 flood. (Knapp-USGS)
W71-01806

DAMPED COOSCILLATING TIDE WITH NEGATIVE REFLECTION AT THE END OF THE ESTUARY,
Ecole Polytechnique, Montreal (Quebec).
For primary bibliographic entry see Field 02L.
W71-01808

LABORATORY INVESTIGATION OF THE TURBULENT DIFFUSION IN OPEN CHANNEL BY MEANS OF SALT WATER INJECTION,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-01809

ON VERTICAL SALINITY DISPERSION INTO FRESH WATER OVER SALT WATER DUE TO TURBULENCE,
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02L.
W71-01810

MATHEMATICAL MODEL OF THE RECOVERY OF SALINITY STRATIFICATION IN THE UNSTEADY FLOW REGIME (FRENCH),
Electricite de France, Paris.
For primary bibliographic entry see Field 02L.
W71-01812

THE MECHANICS OF SUSPENDED SEDIMENT DUE TO WAVE ACTION,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01814

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES - OPEN CHANNEL EXPANSIONS,
Utah Water Research Lab., Logan.
Lloyd H. Austin, Gaylord V. Skogerboe, and Ray S. Bennett.
Available from the NTIS as PB-195 928, $3.00 in paper copy, $0.95 in microfiche. Utah Water Research Laboratory Report PRWG71-1, August 1970. 78 p, 51 fig, 7 tab, 24 ref, append. OWRR Project No B-018-UTAH (1).

Descriptors: *Open channel flow, *Subcritical flow, *Model studies, *Channel morphology, *Ex-

pansion, Mathematical studies, Equations, Flow characteristics, Head loss, Flow rates, Velocity, Flow profiles.
Identifiers: *Specific energy.

Analyzing the hydraulics of open channel constrictions has been modified to allow the analysis of energy loss in open channel expansions. The modified subcritical flow technique has been compared with previous methods of analysis using data collected in the laboratory on open channel expansions with vertical walls, and triangular-shaped baffles. Also, a design procedure for such baffled outlet structures has been developed. The expansion ratio has a significant influence upon the hydraulic characteristics of open channel expansions. As the expansion ratio is increased, the degree of nonuniformity of velocity distributions in the expansion structure will increase with consequent increases in energy loss. Any flow instability at the inlet will become more aggravated as the flow moves through the expansion. Thus, the flow at the outlet will be improved if uniform flow with uniform velocity distribution occurs at the inlet. Although such ideal flow conditions cannot usually be expected under field conditions, they can serve as a goal for the hydraulic engineer. (Woodard-USGS)
W71-01836

EXPERIMENTAL STUDIES OF FLOWS WITH HIGH SOLID PARTICLE CONCENTRATIONS,
M. V. Pechenkin.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 157-164, 1969. 8 p, 4 fig, 1 tab, 9 ref.

Descriptors: *Sediment transport, *Pipe flow, *Design flow, Mathematical studies, Equations, Closed conduit flow, Turbulent flow, Pipelines, Sediment distribution, Hydraulics, Kinetics, Suspended load, Particle size, Flow rates, Foreign projects.
Identifiers: *Leningrad (USSR).

Experimental studies by the Laboratory of Hydraulic Transport of Solids in Leningrad, U.S.S.R., on the turbulence characteristics in pipe flows with high sediment concentrations resulted in establishing the relationship between the distribution of suspended particle concentrations and vertical fluctuating velocity components. Experimental studies of flows with high concentrations established the influence of particle concentration on the fluctuation characteristics of the fluid motion. Integration of the continuity equation for the solid phase of the suspension flow incorporating experimental relationships led to a calculation formula for sediment distribution over the depth of a horizontal flow. The formula is valid for the whole range of concentration values from zero to maximum value. (Woodard-USGS)
W71-01920

UNIFORM TURBIDITY CURRENT EXPERIMENTS,
Norges Tekniske Hoegskole, Trondheim. River and Harbor Lab.
Einar Tesaker.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 1-8, 1969. 8 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Turbidity currents, *Test procedures, *Hydraulic models, *Mathematical studies, Flumes, Clays, Slurries, Sands, Flow, Velocity, Density, Slopes, Discharge (Water), Sediments, Interfaces, Turbidity, Equations, Foreign projects.

An experimental study of continuous turbidity currents was made in a 10 m long tank with a submerged, tiltable flume. Clay slurries with varying amounts of fine sand were discharged continuously during two minute periods into the upper part of the flume. Apparently uniform turbidity currents with well defined interface were created. Velocity and density distributions were measured in sections normal to the flow. Characteristic parameters include slope, discharge, and sediments. Nearly linear density distributions were found in many of the runs. Maximum velocities occurred in the lower third of the currents. Data for the bed and interface shear and the apparent eddy viscosity were caluclated. A discussion of some of the results, and comments to the application of existing 'stability' criteria to turbidity currents are included. (Woodard-USGS)
W71-01922

MECHANICS OF TURBULENT FLOW IN SEDIMENT-LADEN STREAMS,
Universidad Central de Venezuela, Caracas. Dept. of Engineering.
For primary bibliographic entry see Field 02J.
W71-01923

TRANSPORT CAPACITY OF TURBULENT TWO-PHASE FLOW,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02J.
W71-01925

A STUDY OF THE AIR-WATER INTERFACE IN AIR-ENTRAINED FLOW IN OPEN CHANNELS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
John M. Killen, and Alvin G. Anderson.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 339-347, 1969. 9 p, 4 fig, 10 ref.

Descriptors: *Air-water interfaces, *Air entrainment, *Flow, *Open channels, Boundaries (Surfaces), Methodology, Electrodialysis, Flow characteristics, Electrodes, Channel morphology, Diffusion, Equilibrium, Turbulence, Equations.
Identifiers: *Analytical expression.

Experimental evidence indicates that the upper boundary of an air-entrained flow is a connected wavy surface rather than a cloud of discrete water droplets. Air is drawn through the rough surface by a process of overturning waves and surface rollers. This entrained air is carried downward by turbulent diffusion against the buoyant forces until an equilibrium is reached giving a stable air concentration distribution. The interface between air and water remains intact and very rough over a great range of flow conditions. The surface waves or irregularities are of random amplitude and of the same order as the total depth of flow. The statistical properties of the interface measured by an electrical probe are described by an analytical expression and related to average air concentrations. (Woodard-USGS)
W71-01926

REPRESENTATION OF NON-GRANULAR BOUNDARIES IN HYDRAULIC MODELS,
Department of State Hydraulic Works, Ankara (Turkey). Research Section.
Yuksel Sayman.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 131-138, 1969. 8 p, 4 photo.

Descriptors: *Sediment transport, *Model studies, *Hydraulic models, *Structure, *Construction materials, *Bentonite, Boundaries (Surfaces), Design, Flow, Spillways, Sediment discharge, Research and development, Foreign projects.
Identifiers: *Ankara (Turkey).

The attributes of bentonite as a material for hydraulic-model boundaries in sediment transport studies is discussed from tests made in the Research Department of the State Hydraulic Laboratories in Ankara, Turkey. Bentonite, a clay substance, can be applied to represent a concrete mass or a rocky block in river beds or rocky bank slopes of river channels and is more suitable than using noncohesive granular materials in large models. By using bentonite, a researcher has an advantage of realizing his ideas on the model in a very short time. He can improve a lot of new variants during a test by breaking off the water of the model for short periods and making necessary troweling, etc., on the bentonite bodies. Examples of applicaton and effects of bentonite in hydraulic models are presented. (Woodard-USGS)
W71-01927

POLYPHASE CURRENTS WITH NONUNIFORM SEDIMENTS AND THE PHYSICS OF RIVER FLOW,
For primary bibliographic entry see Field 02J.
W71-01929

THE EFFECT OF BED FORMS ON THE HYDRAULIC RESISTANCE,
Middle East Technical Univ., Ankara (Turkey). Dept. of Civil Engineering and Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
R. Acaroglu, and Walter H. Graf.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2 (Subject B), Science Council of Japan, Kyoto, p 199-202, 1969. 4 p, 2 fig, 5 ref.

Descriptors: *Sediment transport, *Beds under water, *Open channels, *Closed conduit flow, Slopes, Flow rates, Velocity, Dynamics, Turbulent flow, Resistance, Boundaries (Surfaces), Sediment distribution, Hydraulics, Sediments, Particle size.
Identifiers: *Bed forms, *Hydraulic resistance.

Depending on the kind of conveyance system, the determination of the kinds of sediment transport and the related bed forms may serve different purposes. This paper presents two graphs as follows: Figure 1, Typical slope and velocity relationship for free surface flows; Figure 2, Typical slope and velocity relationship for closed conduits. The striking similarities between the slope and mean flow velocity relationships shown in Figures 1 and 2 give valuable support to the existence of a close interrelation between the mechanisms of the two different sediment transport phenomena. (Woodard-USGS)
W71-01931

DISTRIBUTION OF SUSPENDED MATTER AND SIMILARITY CRITERIA IN SETTLING BASINS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulic and Water Power.
Kazim Cecen, Mehmetcik Bayazit, and Mutlu Sumer.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 215-225, 1969. 11 p, 5 fig, 6 ref.

Descriptors: *Sedimentation, *Hydraulic similitude, *Hydraulic models, Mathematical models, Diffusion, Turbulence, Dimensional analysis, Settling velocity, Froude number, *Settling basins.
Identifiers: *Sedimentation models.

A mathematical model was established for the settling of suspended grains in a turbulent flow using the law of conservation of matter and employing the assumptions made by Taylor and Elder for turbulent diffusion. The solution of this equation gives an expression for the suspension concentration in a settling basin. This expression is used to determine

the similarity criteria for settling basins. The distribution of concentration is found to depend on three nondimensional variables. Models of settling basins must have Froude similarity, and the settling velocity of the grains must be scaled in the same way as the flow velocity. (Knapp-USGS)
W71-01937

THE TURBULENCE WITH FINE PARTICLES IN UPWARD FLOW,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01938

ON THE MECHANICS OF SALTATION OF A SPHERICAL SAND PARTICLE IN A TURBULENT STREAM,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02J.
W71-01939

SOME DYNAMIC PROBLEMS OF THE MECHANICS,
V. M. Ljatkher, and B. I. Didoukh.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 85-93, 1969. 9 p, 1 fig, 5 ref.

Descriptors: *Unsteady flow, *Flow, *Porous media, *Fluid mechanics, Seepage, Stress, Tailwater, Earthquakes, Dam failure, Drainage systems, Soil mechanics.
Identifiers: Multiphase porous media.

The basic concepts of the mechanics of two- or three-phase porous medium subjected to dynamic effects are developed, the system of equations is given, and the basic one-dimensional boundary problems considering the interaction between the 'skeleton' of the pore medium and the fluid in the pores are formulated and solved. The statement and the results of the boundary problems solution can be used for calculation of vibrations of protection slabs in the tailwater of hydraulic structures, solving for pressure pulsations in drainage systems, evaluation of the conditions initiating debris flow, and for calculation of the earth dam deformations caused by earthquakes. (Knapp-USGS)
W71-01946

RELATIONSHIP BETWEEN VELOCITY OF SEEPAGE AND HYDRAULIC GRADIENT IN THE ZONE OF HIGH VELOCITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
Gyorgy Kovacs.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 25-38, 1969. 14 p, 5 fig, 2 tab, 11 ref.

Descriptors: *Darcys law, *Groundwater movement, Particle size, Particle shape, Porosity, Permeability, Hydraulic conductivity, Hydraulic models, Model studies, Viscosity, Mathematical studies, Froude number, Turbulent flow.
Identifiers: *High-velocity groundwater flow.

The general validity of Darcy's law is discussed; the best formula for calculating Darcy's hydraulic conductivity is the Kozeny-Carman equation. About 300 data from 14 experimental series executed in 4 different laboratories were used for the investigation of homodisperse samples of spheres. Equations of movement characterizing different types of seepage are derived as a function of Reynold's number. The differences are caused by the grains contacting each other not only at a single point, but on various surfaces. Thus the total active surface of grains is smaller than that taken into account for determination of the shape coefficient, and, therefore the samples represent another shape coefficient which differs from the calculated one. (Knapp-USGS)
W71-01947

THE LINEAR AND NON-LINEAR REGIMES OF THE FILTRATION LAW AND THEIR CONSEQUENCES IN GEOHYDRAULIC PROBLEMS,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02F.
W71-01948

FLOW OF IMMISCIBLE FLUIDS IN UNCONFINED AQUIFERS,
For primary bibliographic entry see Field 02F.
W71-01951

RESEARCH OF THE SOLID-LIQUID FLOWS WITH HIGH CONSISTENCE,
Akademiya Nauk URSR, Kiev.
N. A. Silin, Yu. K. Vitoshkin, V. M. Karasik, and V. F. Ocheretko.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 147-156, 1969. 10 p, 4 fig, 2 ref.

Descriptors: *Sediment transport, *Pipe flow, *Model studies, Fluid mechanics, Sediments, Pipelines, Dynamics, Turbulent flow, Sediment distribution, Particle size, Flow rates, Mathematical studies, Equations, Foreign projects.
Identifiers: *USSR.

Two methods for studying flow characteristics of solids with fluids in pipelines are presented. The first is based on the measurements of the instantaneous velocities and the liquid-solid component consistence in an arbitrary flow point by means of photographs and motion pictures. The second method is based on the hydrodynamic tube measurements of the average longitudinal velocity of a small volume mixture in arbitrary part of two-phase flow. Comparison of the results showed a possibility of an application of the hydrodynamical tubes for the measurements in the two-phase flows. (Woodard-USGS)
W71-01952

THE STRUCTURE OF NATURAL TURBULENT SEDIMENT-LOADED STREAMFLOW,
Gidrometeorologicheskii Institut, Odessa (USSR).
For primary bibliographic entry see Field 02J.
W71-01955

THE CHARACTERISTICS OF FLOW WITH WASH LOAD,
Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W71-01957

THE ANALYSIS OF THE FLOW OF LAYERED FLUIDS,
New South Wales Univ., Kensington, (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01959

INVESTIGATION OF AXISYMMETRICAL STRATIFIED FLOW TOWARDS A POINT SINK,
Tokyo Inst. of Tech. (Japan); and Japan Atomic Power Co., Tokyo. Civil Engineering Section.
For primary bibliographic entry see Field 05G.
W71-01960

EFFLUENT FROM A SLOT INTO STAGNANT OR MOVING AMBIENT FLUID OF GREATER DENSITY,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 05G.
W71-01961

THEORETICAL DESCRIPTION OF FREE SURFACE TWO-PHASE FLOW OVER A WAVY BED,
Universidad Central de Venezuela, Caracas. Hydraulics Lab.
Marco Falcon.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 2, (Subject B), Science Council of Japan, Kyoto, p 139-146, 1969. 8 p, 8 ref.

Descriptors: *Sediment transport, *Theoretical analysis, *Free surfaces, *Flow, *Streambeds, Model studies, Channel morphology, Channel flow, Mathematical studies, Equations, Analytical techniques, Sediment load, Suspensions, Particle size, Bed load, Turbulent flow, Flow rates, Flow resistance, Fluid mechanics.
Identifiers: *Wavy channel bed, Erodible bed, Two-dimensional diffusion equation, Caracas (Venezuela).

In Caracas, Venezuela, an analytic model of free surface flow carrying suspended sediment over an erodible bed together with a two-dimensional sediment diffusion equation was used to study the interaction of the sediment and fluid phases. The free surface flow model is based on the potential flow over a two-dimensional, slowly moving, wavy bed with a sinusoidal profile of varying amplitude. The effect of the bed forms on the concentration of sediment within the flow is found and used to obtain the sediment transport rate and the phase shift between it and the bed form profile. Expressions are also found for the rate of amplitude growth and rate of longitudinal displacement of the bed forms. (Woodard-USGS)
W71-01962

A THEORY OF TURBULENCE IN STRATIFIED FLUIDS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics.
Robert R. Long.
Journal of Fluid Mechanics, Vol 42, Part 2, p 349-365, June 1970. 21 ref.

Descriptors: *Stratified flow, *Turbulence, *Density stratification, Fluid mechanics.
Identifiers: *Richardson number, *Density gradient.

The theoretical analysis of an idealized experiment in which turbulence of a patchy nature is precurred to exist in regions of large Richardson numbers, is presented in this paper. The theory for turbulent flow over a flat plate which is moved and cooled in such a way as to produce constant vertical fluxes of momentum and heat is developed. It is indicated that in a coordinate system fixed in the plate the mean velocity increases linearly with height z above a turbulent boundary layer and the mean density decreases as Z cu, so that the Richardson number is large far from the plate. For this theory the curvature of the density profile states that when the curvature is negative a volume of fluid, thoroughly mixed by turbulence, will tend to flatten out, at a new level well above the original center of mass, thereby transporting heat downward. When the curvature is positive a mixed volume of fluid will tend to fall a similar distance, again transporting heat downward. The relationship between the curvature of the density profile and the transfer of heat suggests that the density gradient near the level of a point of inflection of the density curve will increase locally as time goes on. It is concluded that in natural circumstances, it appears that layers of strong shear and density gradient will tend to

form wherever the curvature of the density profile changes sign. (Herrera-Vanderbilt)
W71-02056

STATISTICAL PROPERTIES OF TURBULENT DENSITY FLUCTUATIONS,
IIT Research Inst., Chicago, Ill.
L. N. Wilson, and R. J. Damkevala.
Journal of Fluid Mechanics, Vol 43, Part 2, p 291-303, August 1970. 10 fig, 7 ref.

Descriptors: *Turbulent flow, *Mass-density fluctuations, *Refractive index, *Density gradient.
Identifiers: *Crossed-beam technique, *Schlieren instrument, *Density fluctuations.

This paper presents the study of the local refractive index fluctuations from which mass-density fluctuations can be inferred directly, both being local properties of a fluid, by employing the crossed-beam correlation technique. The refractive index changes are monitored by using the crossed-beam as a Schlieren instrument, the signals obtained then being a measure of refractive index gradients. Since crossed-beam geometry results in an over integral in the cross-flow direction, these gradients tend to be integrated out and no independent scale-length estimates are then required. Some analysis and experimental results concerning the crossed-beam Schlieren instrument and a description of it is presented. It is established that density fluctuations are related isentropically to the pressure fluctuations, which in turn are driven by inertial fluctuations. A conclusion is that optical cross-correlation techniques can be used with Schlieren instruments to obtain density fluctuation statistics in turbulent flows. (Herrera-Vanderbilt)
W71-02057

LOW-FREQUENCY MODULATION OF THERMAL INSTABILITY,
Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
S. Rosenblat, and D. M. Herbert.
Journal of Fluid Mechanics, Vol 43, Part 2, p 385-398, August 28, 1970. 5 fig, 7 ref.

Descriptors: *Temperature gradient, *Buoyancy force, *Flow boundaries.
Identifiers: *Thermal instability, *Temperature fluctuations, *Rayleigh number, Boussinesq equation, *Disturbances in flow.

According to Venezian's paper, an incompressible viscous fluid is confined between parallel horizontal planes, and is of infinite horizontal extent. An equilibrium state is maintained under the action of a vertical temperature gradient, which combines a uniform component together with a component varying sinusoidally in time. It is found that this equilibrium is unstable to small disturbances at certain values of the relevant parameters. A solution is obtained by an approximation method based on the smallness of the amplitude ratio in order to determine the modulating effect of the oscillation on the stability characteristics of the mean gradient. It is concluded that for a certain class of disturbances, those of which linearization is valid and whose initial values are independent of frequency, the periodicity criterion is a sufficient condition for instability. (Herrera-Vanderbilt)
W71-02059

MASS OF HEAT TRANSFER FROM A SOLID BOUNDARY TO A TURBULENT FLUID,
Institut Politehnic Bucuresti (Rumania).
E. Ruckenstein.
Int. Journal of Heat and Mass Transfer, Vol 13, p 1283-1291, Pergamon Press. 10 ref.

Descriptors: *Mass transfer, *Heat transfer, Turbulence, Boundary processes, Turbulent flow, Laminar flow, Temperature, Energy equation, Momentum equation, Diffusion, Reynolds number.
Identifiers: Turbulent heat, Prandtl's equation.

The problem of turbulent heat or mass transfer from a solid boundary is treated by dividing the turbulent flow into two regions. For the region in the immediate vicinity of the wall one uses a physical model proposed previously by the author. In the model one considers the turbulent motion as a succession along the wall of quasi-steady laminar motions each of them having a short path. Compared to the preceding treatment, in the present one takes into account various forms of dependence of the shear stress on the distance y to the wall. For a constant shear stress the case of the turbulent motion in a pipe is obtained, while for a shear stress proportional to y that of turbulent separated flows near the separation point. For the fully turbulent region, Prandtl's equation for the turbulent kinetic energy is used and on its basis one obtains an equation for the turbulent diffusion coefficient and for the mass transfer flux. The equation for the turbulent kinetic energy has allowed to propose a procedure for obtaining information concerning the length x sub o of the laminar path. The form of dependence of the shear stress on the distance from the wall has a great influence on the manner in which the mass transfer coefficient depends on the diffusion coefficient, viscosity and fluid viscosity. (Novotny-Vanderbilt)
W71-02060

THE STABILITY OF STRATIFIED SHEAR FLOWS,
Essex Univ., Colchester (England). Dept. of Mathematics.
M. R. Collyer.
Journal of Fluid Mechanics, Vol 42, Part 2, p 367-377, June 22, 1970. 4 fig, 1 tab, 7 ref.

Descriptors: *Stratified flow, *Shear flow, *Stability, *Jet flow, *Density stratification, Fluid mechanics.
Identifiers: *Richardson number, *Wave equation, *Neutral curve.

In this paper, the study of small perturbations of a parallel shear flow U (z) in an inviscid, incompressible stably stratified fluid of rho (z), for which the principal measure of stability is the Richardson number R, is being presented. A discussion for an arbitrary velocity and density profile is presented, to determine whether a curve of neutral stability has adjacent unstable regions in an (alpha, R) plane, where alpha is the wave number of disturbance. Neutral curves bounding unstable regions are then obtained for a triangular jet flow in conjunction with various density distributions. A comparison is also made between the stability characteristic of jet and shear flows with corresponding density structures and is concluded that the possibility of no unstable waves develop for certain values of N in the uppermost layer appears to be its principal distinction. It is also concluded that: It's evident for any combination of velocity and density profiles studied, the flow is unstable if R A1/4 at any level, unless the unstable wavelengths cannot be excited due to restrictions imposed by the boundary conditions. (Herrera-Vanderbilt)
W71-02061

CHANNEL FLOW INDUCED BY A TRAVELLING THERMAL WAVE,
Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
Chuen-Yen Chow.
Journal of Fluid Mechanics, Vol 43, Part 2, p 419-429, August 1970. 7 fig, 7 ref.

Descriptors: *Thermal conductivity, *Fluid velocity, Channel flow, Fluid motion, Reynolds number.
Identifiers: *Traveling thermal wave, *Induced motion, *Prandtl number, *Thermal boundary conditions.

According to Davey's analysis the results were presented only for the limiting cases in which the frequency of flame rotation was either very low or very high. The purpose of this work is to fill in this gap, within which the fluid speed is much greater and reaches a maximum, and to show the change in mean velocity profile as the frequency increases. The effect of thermal boundary conditions of the flow and shear stress is also analyzed. It was found in previous analysis that the induced fluid motion does not exert a net shear force on either plate when the fluid is bounded by two parallel plates. It is shown in this paper that this is the result of the assured thermal boundary conditions. An analysis is carried out linearized under the assumption that the induced motion is slower than the speed of the heat source. Experiments showed that a mean fluid motion can be induced in a channel by a traveling thermal wave, this mean motion being always in a direction opposite to that of the thermal wave. An analysis is presented to indicate that the induced mean motion is always in a direction opposite to that of the thermal wave and its magnitude increases rapidly with decreasing Prandtl number is zero. (Herrera-Vanderbilt)
W71-02067

DISCUSSION OF DISPERSIVITY TENSOR FOR TURBULENT UNIFORM CHANNEL FLOW,
California Univ., Berkeley.
Hugo B. Fischer.
In: Proceedings, American Society of Civil Engineers, Journal of Hydraulics Division, p 1096-1100, April 1970. 2 fig, 1 tab, 3 ref.

Descriptors: *Channel flow, *Turbulent flow, *Uniform flow, *Diffusion, *Dispersion, Eddies, Turbulence.
Identifiers: *Fickian transport coefficient.

This paper presents a discussion of the work presented by Gedeon Dagan in September, 1969, where the author points out that turbulent mixing coefficient may be considered to be a second order tensor. It is said that neither form can provide an exact representation of the diffusive effects of turbulence, but that in many cases the nature of the physical process is such that the averaged scaler representation is at least as correct as, and sometimes, more correct than, the tensor. It is also discussed that according to the author's conclusion, in three dimensional turbulent flow, the isovels represent a principal axis for a mixing tensor for both mass and momentum. The writer of this discussion does not agree, because whereas the local orientation of the isovels does not reflect the concentration distribution at some distance from a point, the concentration distribution at some distance does affect the local mass transport. Examples and analysis of these discussions are presented. (Herrero-Vanderbilt)
W71-02068

SYSTEM SIMULATION FOR ANALYSIS AND DESIGN,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-02082

8C. Hydraulic Machinery

COMPUTER CONTROLS AND MEASUREMENTS: WALTZ MILL 1100 KV UNDERGROUND TRANSMISSION TEST FACILITY,
Westinghouse Electric Corp., East Pittsburgh, Pa.
F. S. Young.
Trans Pap 70 TP 558 - PWR, Inst Elec Electron Eng Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 10 p, 9 fig, 11 ref.

Descriptors: Transmission (Electrical), *Electric cables, *Extra high voltage, Computers, *Test facilities, *Control systems, Measurement, *Instrumentation, Test procedures, Testing, Process control, Computer programs, Temperature.
Identifiers: *High voltage, *Underground cables, Waltz Mill Project (Pa), Underground transmission lines, Electric conductors.

The Waltz Mill Project in Pennsylvania is a research center devoted to performing accelerated life testing of underground transmission systems. Prototype samples can be tested at voltages ranging from 115 to 1100 kv. The control systems, instrumentation circuits, and computer programs available at the facility for cable testing are described. If feasible, when prototypes of resistive cryogenic, super-conducting, gas insulated, extruded dielectric, and other underground transmission systems rated in voltages from 115 kv to 750 kv become available, sample sections may be installed and tested at the Waltz Mill Underground Transmission Test Facility. (USBR)
W71-01728

TECHNIQUES TO EVALUATE THE TRANSIENT PERFORMANCE OF CABLES AND JOINTS,
Southampton Univ. (England); and Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
B. M. Weedy, and M. J. Thelwell.
Conf Pap 70 CP 530 - PWR, Inst Elec Electron Eng Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 10 p, 14 fig, 6 tab, 11 ref, 2 append.

Descriptors: Extra high voltage, *Electric cables, *Analogs, Heat flow, *Joints (Connections), Performance, Computers, Analysis, Transients, Thermal properties, Foreign research, Resistors, Capacitors, Cooling, Water cooling.
Identifiers: High voltage, *Temperature rise, Great Britain, Test results.

Computational methods used to evaluate the transient temperature rises in high-voltage cables and joints caused by operational changes occurring in the system are reviewed. The development and use of resistance-capacitance network analogs to solve the 2- and 3-dimensional heat flow problems in cables and joints, respectively, are described. Limitations of the calculation methods and the use of computer solutions are discussed, and results are given. (USBR)
W71-01729

THE NUKES ARE COMING.

Quest, Vol 8, No 2, p 2-21, Apr 1970. 20 p, 12 fig, 1 tab.

Descriptors: Electric powerplants, *Electric power production, Coals, *Nuclear powerplants, *Hydroelectric power, Planning, Safety, Cooling water, Nuclear wastes, Inter-basin transfers, Scheduling, Construction, Transmission lines, Locations, Thermal pollution, Radiation hazards, Cooling towers.
Identifiers: *Nuclear power, *Hydroelectric resources, Nuclear fuels, Pacific Northwest-Southwest Intertie, Nuclear radiation, Fossil fuels.

The Pacific Northwest is about to begin a new era of electric power production. Hydroelectric expansion is nearly at an end, with only a few sites remaining that meet the requirements for a hydro dam. Sites meeting the physical criteria for hydro dam installations are subject to controversy among power-producing agencies, conservationist organizations, and sportsmen groups. Regional power deficits predicted for as early as 1973-74 are alarming. Coal-fired and nuclear-fueled powerplants and attendant problems are discussed. Radioisotope leakage, natural radiation levels, somatic and genetic hazards of radiation, reactor safeguards, and problems of storing spent uranium fuel are reviewed. With the ever-increasing demand for electric energy, nuclear power appears to be the coming source in the Pacific Northwest. (USBR)
W71-01730

PRESTRESSED ROCK ANCHORS AND SHOTCRETE FOR LARGE UNDERGROUND POWERHOUSE,
M. Buro.
Civ Eng, Vol 40, No 5, p 60-64, May 1970. 5 p, 4 fig, 2 photo, 5 ref.

Descriptors: *Prestressing, *Underground powerplants, *Rock bolts, *Tunnel linings, *Anchors, Soil stabilization, Pumped storage, Costs, Construction, Foreign construction, Extensometers, Overbreak, Safety, Rock excavation, Grouting, Instrumentation, Rock mechanics, *Gunite, Underground structures, Post tensioning.
Identifiers: Switzerland, *Shotcrete, Underground cavities, *Hongrin Power plant, Switzerland, Tunnel supports, Anchor cables.

The Hongrin underground pumped storage station in Switzerland used prestressed rock anchors and shotcrete lining in the underground powerplant, 450 by 100 ft in plan and with arched ceiling 90 ft high, a total excavated volume of 2.9 million cu ft. Stabilization with prestressed rock anchors is distinguished from the more conventional lining methods by the fact that prestressing creates an active arch in the rock, making it act as its own structural support. Such a structure adapts to rock deformation until the whole mass stabilized completely. Excavation began in small longitudinal galleries following the contour of the arched ceiling; the galleries were made large enough to permit drilling and installing rock anchors, but small enough to minimize scaffolding and bracing. Other advantages of the excavation technique include less rock overbreak, lower labor costs, and improved crew safety. Details of the prestressed rock anchors and the 10-step procedure used in constructing the powerplant are described. (USBR)
W71-01735

COLLECTION OF RECENT USSR NEWSPAPER ARTICLES ON POWER GENERATION AND TRANSMISSION IN THE SOVIET UNION.

USR Power Generation and Transmission, Transl from Russ, Bur Reclam Transl 716, July 1970. 132 p, 26 fig, 6 map.

Descriptors: *Reviews, Foreign construction, Extra high voltage, Extra long distance, *Transmission (Electrical), Electric power, *Power system operations, *Electric power production, Electric powerplants, Electric power costs, Multiple-purpose projects, Project planning, Geography, Powerhouses.
Identifiers: USSR, *Power grids, Power interchange, Interties, International cooperation.

A collection of recent Soviet newspaper articles on the electric power generation and transmission aspects of the efforts of the USSR to meet energy needs is presented. The articles have been translated, and in the case of longer articles of marginal interest, have been abstracted to review Soviet accomplishments of the last decade and plans for the future. The result is a general picture of a huge country with difficult geography trying to stretch the energy ruble to include thermal, hydraulic, tidal, geothermal, and nuclear powerplants, and to transmit the energy produced over long transmission lines across plains, mountains, deserts, taiga forest, and permafrost tundra. Unification of sectional power systems by ehv interties into the United Power System of European Russia was achieved during the last decade; gradual extension to the whole country is the goal for the seventies. Providing power from the energy-rich areas of Siberia to European Russia with enough surplus to export to the Comecon countries via the Mir 400-kv line is a constant problem because the demand for electrical energy and the population are growing not only in the western highly industrialized areas but also in the developing Siberian and Central Asian regions. (USBR)
W71-01742

GRAND COULEE 230- AND 115-KV PIPE-TYPE CABLE SYSTEMS,
Bureau of Reclamation, Denver, Colo.
J. J. Ray, and R. J. Mueller.
Conf Pap No 70 CP 559 - PWR, Inst Elec Electron Eng Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 7 p, 10 fig, 3 ref.

Descriptors: *Electric cables, *Installation, Coolants, Temperature, Aesthetics, Electric power, *Transmission (Electrical), High pressure, Field tests, Costs, Electric insulation, Electrical equipment, Design.
Identifiers: *Pipe-type cables, *Cooling systems, *Insulating oil, *High voltage, Cable terminations, Grand Coulee Powerplant, Wash.

Modification work to existing Grand Coulee electrical facilities consists of six 230-kv and two 115-kv pipe-type cable circuits to serve as the transformer circuits between the powerplants and the 230-kv consolidated switchyard and 115-kv switchyard on the west bank. The circuits replace the original 19 overhead transformer circuits. Design and installation of the high-pressure oil, pipe-type cable systems for Grand Coulee Left and Right Powerplants required consideration of unusual parameters such as the 650 ft of elevation difference between terminals, restricted circuit routing, and variable ambient conditions. The resulting cable construction details, pothead configuration, oil circulation, and cable cooling systems are described. Critical time schedules for energization introduced factors into the installation work, which complicated an already difficult job. Innovative procedures and equipment are described and the effectiveness of skid wire design and cable pulling lubrication are analyzed. (USBR)
W71-01743

INVESTIGATION OF PERFORMANCE CHARACTERISTICS FOR SANITARY PLUMBING FIXTURES.
National Bureau of Standards, Washington, D.C. Building Research Div.
For primary bibliographic entry see Field 05D.
W71-02052

CHANGING EMPHASIS IN THE SITING OF STEAM ELECTRIC POWER STATIONS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05C.
W71-02063

8D. Soil Mechanics

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME I,
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.
For primary bibliographic entry see Field 02C.
W71-01665

EVALUATION OF SOILS AND PERMAFROST CONDITIONS IN THE TERRITORY OF ALASKA BY MEANS OF AERIAL PHOTOGRAPHS, VOLUME II.
Purdue Univ., Lafayette, Ind., Engineering Experiment Station.
For primary bibliographic entry see Field 02C.
W71-01666

PHENOMENON AND MECHANISM OF FROST HEAVING,
Cold Regions Research and Engineering Lab., Hanover, N.H.
C. W. Kaplar.
Highw Res Rec, No 304, p 1-13, 1970. 13 p, 13 fig, 1 tab, 22 ref.

Descriptors: *Frost heaving, *Frost action, Freezing, *Frozen soils, *Frozen ground, Soils, Laboratory tests, Soil structure, Soil pressure, *Heaving, Ice, Soil mechanics, Soil water, Highways, Bibliographies, Negative pressure, Soil water movement.

Identifiers: Liquid films, Ice lenses, Subpressure.

A mechanistic explanation of frost action in soils, based on the hypothesis that liquid films existing between particles and an ice lens are the focal centers of energy for the heaving process, is presented. An explanation of the development of suction forces in unfrozen liquid below the ice lens is presented, and experimental data are provided for closed and open systems. The effect of heat extraction and freezing penetration rates on rate of heaving is discussed. Laboratory data indicate 2 critical rates of freezing: (1) maximum heave rate, and (2) minimal heave rate equal to volume expansion of void water. The role of soil structure in frost susceptibility is discussed. Changes in frost heaving rates can be effected by the addition or removal of either or both coarse aggregate or soil fines. Suggestions are offered for approaches to soil modification to reduce heaving. (USBR)
W71-01726

LOW-TEMPERATURE EFFECTS ON THE COMPACTION AND STRENGTH OF A SANDY CLAY,
Purdue Univ., Lafayette, Ind.
W. H. Highter, A. G. Altschaeffl, and C. W. Lovell, Jr.
Highw Res Rec, No 304, p 45-51, 1970. 7 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Cold weather construction, Earthworks, *Embankments, Soil mechanics, *Compaction, Soil strength, Clays, Statistical analysis, Dry weight, Compressive strength, Axial strain, Temperature, Laboratory tests, Construction, Compaction tests, Bibliographies, Soil structure, Pore water pressures.
Identifiers: Undrained shear strength.

With the feasibility of increased cold weather earthwork as a practical motivation, the compaction and strength characteristics of a sandy clay were studied in the laboratory over a temperature range of 35 to 85 deg F. The soil was compacted at 3 effort levels and at 4 water content levels for each effort level. The strength and stiffness of soil tested at one temperature but compacted at different temperatures increased with increasing compaction temperature. For soil compacted at the same temperature, the strength and stiffness increased with decreasing test temperature. Conclusions were (1) low temperature compaction reduces unit weight and as-compacted undrained strength; (2) compacted samples are stronger and stiffer when tested at low temperatures; (3) low temperature compaction effects can be compensated by increasing the compaction effort; (4) observed trends are probably seated in the factors of soil structure and pore water pressure; and (5) there seems to be no major deterrent to compaction of clayey soils in a cold, but unfrozen, condition. (USBR)
W71-01727

DESIGN AND PERFORMANCE OF PROVISIONS FOR FOUNDATION SEEPAGE CONTROL AT GARDINER DAM,
A. S. Ringheim.
Eng J, Can, Vol 53, No 4, p 17-25, Apr 1970. 9 p, 8 fig, 1 tab, 5 ref, disc.

Descriptors: Dams, *Dam foundations, Dam design, *Earth dams, Cutoff trenches, Seepage, Filters, Previous blankets, Drainage systems, Relief wells, Underseepage, Impervious blankets, Foreign construction, Foreign design practices, Performance, Underwater construction, Drains.

Gardiner Dam is a 210-ft-high, zoned earthfill embankment located in south-central Saskatchewan, Canada. Bedrock at the damsite is impervious Bearpaw Shale that outcrops near river level on both sides of the river. In the river channel, up to 110 ft of stratified pervious sand overlies bedrock. Right abutment overburden is dense, glacial till with layers and pockets of pervious materials. Overburden on the left abutment consists of up to 60 ft of interbedded sand, silt, and clay overlain by 40 to 50 ft of clean, free draining sand and gravel. Several alternatives for seepage control are discussed, including a positive cutoff trench to bedrock, steel sheet piling, and an impervious reservoir blanket. Seepage control measures adopted for the river channel section of the dam were: (1) a reservoir blanket covering the full width of the river and extending 1200 ft upstream from the dam, and (2) a filter blanket and pressure relief wells under the downstream toe of the dam. For the remaining portions of the dam, a positive cut-off trench was constructed to bedrock, and filter blankets and toe drains were constructed under the downstream embankment zones. Provisions for seepage under the spillway and locations and physical features of the entire seepage control system are presented. (USBR)
W71-01736

STABILIZATION OF HYDRAULIC BACKFILL WITH PORTLAND CEMENT: INCLUDING RESULTS WITH OTHER ADDITIVES,
Bureau of Mines, Spokane, Wash.
D. R. Corson.
Report No. RI 7327, Bur Mines, Jan 1970. 33 p, 20 fig, 9 tab, 18 ref.

Descriptors: Soil stabilization, Soil engineering, Soil mechanics, Soil strength, Soil cement, Soil tests, *Hydraulic fills, Effects, Earth materials, Backfill, *Portland cements, *Stabilization, Bibliographies, Compressive strength, Permeability, Admixtures, Regression analysis, Strength, Laboratory tests, Gradation, Cements, Density.
Identifiers: Compression tests, Triaxial tests, Permeability tests, Cement content.

Tests to determine the effect on the strength and permeability of hydraulic backfill by addition of varying amounts of Type I portland cement are described. Unconfined compression, triaxial compression, and permeability test data, and data from tests to determine effects of moist curing and fill densification on strength are given. Two strength prediction equations based on the physical and mineralogical properties of the materials were formulated. The equations accounted for 96 and 99% of the data variability, and yielded reasonable estimates of cemented strengths of materials having properties within the range of those used in the analysis. Gradation and cement content are the primary factors affecting sample strength; silica content is significant only in rich (5 to 1) sand-cement mixes. Triaxial tests showed higher strength for well-graded material and higher cohesion for fine material. Samples moist-cured in plastic bags had significantly lower strengths than comparable samples cured in room atmosphere. An increase in dry density of approximately 10 lb/cu ft resulted in 7-day strength increases of 25 to 67% Permeability decreased with increases in cement content and curing time. Has 18 references. (USBR)
W71-01740

STABILIZATION OF SHEAR-GENERATED SOIL AGGREGATES,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W71-01771

8E. Rock Mechanics and Geology

DISTRIBUTION OF STRESSES IN DISCONTINUOUS LAYERED SYSTEMS,
Coyne et Bellier, Paris (France).
V. Maury.
Water Power, Vol 22, No 5/6, p 195-202, May/June 1970. 8 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Stress distribution, Stress analysis, Discontinuities, *Rock foundations, *Rock mechanics, Dam foundations, Deformation, Model studies, Stability, Theoretical analysis, Photoelasticity, Model tests, Interferometers, Models, Research and development, Friction, Foreign research.
Identifiers: Rock interfaces, Photoelastic interferometer, Comparative studies, France, Photoelastic model material.

Because of the complexity of determining stress patterns in rock foundations, deformation and stability of rock foundations for dams are based on approximate assumptions. Rock is assumed to be a continuum even though the fundamental characteristic of rock is that of discontinuity. A research program to investigate the stress distribution in discontinuous systems under applied loads is described. A theoretical method of analysis suitable for calculating stresses in stratified systems for cases of perfect bonding or perfect sliding between layers is presented. The method cannot be used for cases of friction between layers. Tests of photoelastic and interferometric models were used to check the theoretical analysis and to investigate the effect of different degrees of friction between layers. Assumptions used in the theoretical analysis that need refinement to reflect accurately the state of stress can be identified by comparing theoretical and experimental results. Then the model can be used to examine the change in mode of reaction when there is friction between layers. (USBR)
W71-01721

FAST-RESPONSE EQUIPMENT FOR ACOUSTIC LOGGING,
V. G. Gratinskii.
Phys Solid Earth, No 12, p 768-774, Dec 1969. 7 p, 6 fig, 15 ref.

Descriptors: *Borehole geophysics, Boreholes, Geophysics, Analogs, Seismographs, Oscilloscopes, Rock properties, *Acoustic equipment, Drill holes, *Logging (Recording), *Subsurface investigations, Exploration, Bibliographies.
Identifiers: *Acoustic logging, Geophysical logging, Probes (Instruments), Elastic waves.

An experimental model of a type of fast response equipment for investigating physical and mechanical properties of rocks in boreholes was developed. The equipment records in analog form a maximum of information on the acoustic signals at individual points of a borehole and obtains continuous diagrams indicating the variation of the most important signal parameters along the profile. All observations are made while the probe moves at a constant rate in the borehole. The equipment has improved characteristics of the acoustic elements lowered into the borehole emitters, pickups, and acoustic insulators. Field tests showed that the equipment works reliably even in profile sections which greatly complicate the investigatons, namely in rocks characterized by low velocities and high absorption of the elastic waves. (USBR)
W71-01725

PRESTRESSED ROCK ANCHORS AND SHOTCRETE FOR LARGE UNDERGROUND POWERHOUSE,
For primary bibliographic entry see Field 08C.
W71-01735

8F. Concrete

CONCRETE PLACEMENT (SPLIT LEVEL - NO VERTICAL JOINT SCHEME),
O. R. Lunn.
Pap, Conf Rapid Constr Concr Dams, Asilomar, Calif, Mar 1970. 15 p, 5 fig.

Descriptors: *Concrete dams, *Concrete placing, Concrete construction, Mass concrete, Temperature control, Dam construction, Dams, Construction costs, Monoliths, Construction joints, Construction, Cooling, Vertical joints, *Formwork (Construction), Lifts (Construction).
Identifiers: *Construction methods, Precast concrete forms, Cost savings.

A method of constructing concrete dams using insulated, precast concrete panels as upstream and downstream forms and a concrete placing method that eliminates vertical joints is presented. Technical and construction advantages of using the precast concrete forms are tabulated. The concrete placing method consists of placement of 65-ft-wide blocks or monoliths in 5-ft lifts with overlapping edges. To minimize the slope area of the overlapping edges, a split-level concept is used, consisting of placing alternate blocks and keeping the difference of top elevation of adjacent blocks at one-half lift height. Pipe cooling is provided for temperature control. The method allows an almost level surface throughout construction, making the top of the dam a safer place to work; concrete placement is easier and can be expected to result in more consistent quality; all formwork on top of the dam consists of placing precast panels; and continuous placing of concrete by belt conveyors is more feasible. Estimated savings using the method is one dollar per cu yd of concrete for large dams. (USBR)
W71-01723

THE CLYWEDOG RESERVOIR PROJECT,
Halcrow (William) And Partners, London (England).
For primary bibliographic entry see Field 08A.
W71-01738

8G. Materials

DETRIMENTAL EFFECTS OF NATURAL SOIL AND WATER ELEMENTS ON DRAINAGE PIPE STRUCTURES IN ALABAMA,
Geological Survey, Tuscaloosa, Ala. Water Resources Div.
For primary bibliographic entry see Field 08B.
W71-01676

TECHNOLOGY OF CONSTRUCTING CANALS WITH POLYMER MEMBRANE LININGS,
V. V. Zherebtsov, T. A. Chapurskaia, and V. I. Romashkevich.
Transl from Russ, Bur Reclam Transl 840, July 1970. 30 p, 5 fig, 4 tab, disc. Gidrotekh melior, No 6, p 17-25, 1969, and No 2, p 23-24, 1970.

Descriptors: *Canal design, Earth handling equipment, Lower cost canal linings, *Excavation, *Foreign construction, *Buried membranes, Canals, *Canal linings, Impervious membranes, Trenches, Comparative costs, Canal embankments, Polymers, Mechanization, Soil compaction, Polyethylenes, Costs, *Canal construction, Construction materials, Construction.
Identifiers: USSR, *Construction methods, Seepage control, Protective coverings, Plastic film.

With the objective of maximum mechanization, construction technology for placing polyethylene membrane linings in canals has been developed in the USSR. The trench and the perimeter methods were developed for canals in thorough and partial cuts for cohesive, nonsettling soils having high seepage coefficients. The perimeter method can also be used in rocky soils by constructing a layer of fine-grained soil on which to place the membrane. Both methods are described, including sequence of operations and construction equipment. Basic operations for the trench method are: (1) excavate the trench for membrane placement, (2) place the membrane, (3) backfill the trench, and (4) excavate the canal cross section. Basic operations for the perimeter method are: (1) excavate the canal cross section, (2) place the membrane, and (3) place the earth cover. Canal construction in several standard sizes was studied for the methods. Construction output per man-day was about the same as mechanized construction of monolithic concrete linings. Excluding earthwork costs, monolithic concrete lings cost 1.5 to 3 times more than polyethylene membrane linings. A discussion is included suggesting that earthwork costs could be cut in half and hand trimming eliminated by using rotary screw excavators. (USBR)
W71-01739

A TRACER STUDY OF PRESCALING DEPOSITION OF SCALE FORMING COMPOUNDS ON CONTROLLED SURFACES,
North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
Howard L. Recht.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price $0.40. Office of Saline Water Research and Development Progress Report No. 521.

Descriptors: *Scaling, *Calcium Sulfate, *Radioactivity, *Heat Exchangers, Tracers, Desalination, Distillation, Scaling, Corrosion.
Identifiers: Autoradiography, Nucleation, Induction, Radioactive Calcium.

The chemistry and physics were studied of the induction period in the heterogeneous nucleation of heat-exchanger scale to elucidate the mechanism and energetics of the surface influenced processes which are occurring, Solutions of calcium sulfate tagged with radioactive calcium-45 were placed in contact with metal wafers which served as models for heat exchanger surfaces. The level of surface radioactivity after rinsing was related to the amount of calcium sulfate adsorbed on the metal surface. The amounts so adsorbed, at concentration levels below that of bulk deposition can be measured quantitatively. Experiments conducted over a range of solution concentrations, temperatures, and exposure periods yielded adsorption isotherms and adsorption rates. Adsorption studies were conducted on copper and on 90-10 Copper-Nickel alloy. Surfaces were prepared by grinding, polishing, ultrasonic cleaning and thermal etching in the temperature range 125 to 225 F. (Fillian-OSW)
W71-01748

8H. Rapid Excavation

HIGH-PRESSURE WATER JETS FOR UNDERSEA ROCK EXCAVATION,
Exotech Inc., Rockville, Md.
W. C. Cooley, and L. L. Clipp.
Trans Amer Soc Mech Eng, J Eng Ind, Vol 92, Ser B, No 2, p 281-287, May 1970. 7 p, 14 fig.

Descriptors: *High pressure, *Jets, *Rock excavation, Tunneling, *Underwater excavation, Research and development, Fragmentation, Mining, Kinetic energy, Overbreak, Shock waves, Penetration.
Identifiers: *Jet piercing, Rock breakage, Pulsating jets, Wear, Tooling, Rapid excavation, Undersea aqueduct (Collective).

Research on pulsed high-pressure water jets in their application to breaking rock is reviewed. Experiments show the input energy per unit volume required to fracture various types of rock as a function of the pertinent variables. The stagnation pressure of the liquid jets was varied from 50,000 to 5 million psi. Theories of jet penetration through water and air are compared with experimental results. The feasibility and potential advantages of using pulsed water jet equipment for ocean-floor excavation are discussed. Conclusions are that pulsed water cannons offer a promising potential for remote-controlled or manually controlled underwater excavation. The operating jet pressure should be optimum for the type of rock being excavated. Much research and development is needed to optimize a complete underwater excavation system. Potential advantages of continuous remote-control-led operation, flexibility of operation, and absence of tools that wear out make the system attractive for further investigation. (USBR)
W71-01741

BIOENVIRONMENTAL AND RADIOLOGICAL SAFETY FEASIBILITY STUDIES ATLANTIC-PACIFIC INTEROCEANIC CANAL. FINAL REPORT, TERRESTRIAL ECOLOGY,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 05C.
W71-01883

HYDROLOGIC DATA REDUCTION TECHNIQUES AND UNIT CONVERSIONS FOR USE IN THE OGRE, T-WAVE, FLIP, AND RAVE FLUID FLOW CODES,
California Univ., Livermore. Lawrence Radiation Lab.
For primary bibliographic entry see Field 02F.
W71-01887

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

SEA GRANT ACTIVITIES.
Wisconsin Univ., Madison.

Available from NTIS as PB-194 200, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 3, July 1970. 130 p, 21 ref.
Identifiers: *Universities, *Grants, *Oceanography, Technical reports, Rivers, Water pollution, Water quality, Fishes, Natural resources, Fishing, Benthos, Nitrites, Ocean waves, Estuaries, Pile structures, Gravity waves, Geological sedimentation, Geological surveys, Manganese nodules, Mathematical models, Underwater structures, Education, Eutrophication, *Wisconsin University sea grants.

Contents: Green Bay research program; Water quality program (eutrophication); Fishery resources program trash fish utilization; Mineral resources program; Ocean mechanics program; Socio-economics program; Special education programs; Advisory services program; Publications, theses, and papers presented in this time period.
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FERMENTATION INDUSTRY-PHARMACEUTICAL, CORN, SUGAR, (LITERATURE REVIEW),
Oklahoma State Univ., Stillwater.
For primary bibliographic entry see Field 05D.
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MEAT AND POULTRY PROCESSING WASTES (LITERATURE REVIEW),
Battelle Memorial Inst., Columbus, Ohio.
For primary bibliographic entry see Field 05D.
W71-01761

EVALUATION OF FACILITY OPERATION (LITERATURE REVIEW),
Grand Rapids, Mich.
For primary bibliographic entry see Field 05D.
W71-01762

DISINFECTION (LITERATURE REVIEW),
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
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PHYSICAL AND CHEMICAL METHODS (LITERATURE REVIEW),
Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05D.
W71-01766

WATER RECLAMATION AND REUSE (LITERATURE REVIEW),
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
For primary bibliographic entry see Field 05D.
W71-01767

COAL AND COAL MINE DRAINAGE (LITERATURE REVIEW),
Bituminous Coal Research Inc., Monroeville, Pa.
For primary bibliographic entry see Field 05D.
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WASTE WATER AND STORM FLOW TREATMENT (LITERATURE REVIEW),
For primary bibliographic entry see Field 05D.
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COASTAL/ESTUARINE POLLUTION, AN ANNOTATED BIBLIOGRAPHY,
Ocean Engineering Information Service, La Jolla, Calif.
For primary bibliographic entry see Field 05C.
W71-01788

PAPER AND ALLIED PRODUCTS (LITERATURE REVIEW),
Tufts Univ., Medford, Mass.
For primary bibliographic entry see Field 05D.
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PETROLEUM PROCESSING WASTES (LITERATURE REVIEW),
Maine Univ., Orono.
For primary bibliographic entry see Field 05D.
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CANNING (LITERATURE REVIEW),
For primary bibliographic entry see Field 05D.
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THERMAL POLLUTION-BIOLOGICAL EFFECTS, A REVIEW OF THE LITERATURE OF 1969,
Water Pollution Control Federation, Washington, D.C.
For primary bibliographic entry see Field 05C.
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Connecticut Institute for Water Resources	W71-01899	1
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 4, NUMBER 5
MARCH 1, 1971

W71-02201 -- W71-02750

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
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VOLUME 4, NUMBER 5
MARCH 1, 1971

W71-02201 -- W71-02750

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

ELECTROLYTIC CONDUCTANCE AND THE CONDUCTANCES OF THE HALOGEN ACIDS IN WATER,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
Walter J. Hamer, and Harold J. DeWane.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price $0.50. National Standard Reference Data Series National Bureau Standards No 33, May 1970. 32 p, 1 fig, 19 tab, 80 ref, 3 append.

Descriptors: *Electrical conductance, *Halogens, *Water, Electrolysis, Acids, Aqueous solutions, Ionization, Electrodes, Temperature, Theoretical analysis, Methodology.
Identifiers: Specific conductance, Hydrofluoric acid, Hydrochloric acid, Hydrobromic acid, Hydriodic acid.

Definitions, symbols, general principles, and general laws related to electrolytic conductance of aqueous solutions are presented. General laws considered are Coulomb's law for charged bodies, Poisson's equation relating electrostatic potential to charge distribution, and Stokes and Oseen laws for the velocity of a sphere in a fluid medium. Relations between electrical resistance, electrical conductance, specific resistance, specific conductance, and equivalent conductance are presented. Theoretical expressions for equivalent conductance as derived by Debye, Onsager, and Fuoss are given. General methods of treating equivalent conductances of ionophores and ionogens, especially in regard to determination of limiting equivalent conductance, degree of ionic association, and degree of ionic dissociation are discussed. Data on equivalent conductances of the halogen acids, hydrofluoric, hydrochloric, and hydriodic acids in water cover a wide range of concentration and temperature. (Woodard-USGS)
W71-02218

02. WATER CYCLE

2A. General

HYDROLOGY IN COLOMBIA,
Universidad de los Andes, Bogota (Columbia). Center of Technical Studies and Investigations in Hydraulics.
For primary bibliographic entry see Field 09A.
W71-02224

WORLD HYDROLOGY: STATUS AND PROSPECTS,
Geological Survey, Washington, D.C.
Raymond L. Nace.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 1-10, July 1970. 10 p, 2 fig, 1 tab.

Descriptors: *Reviews, *Hydrology, *Hydrogeology, *International Hydrological Decade, Data collections, Sampling, Networks, Data processing, Analytical techniques, Hydrologic budget, Water balance, Synoptic analysis, Rainfall-runoff relationships, Hydrologic data.
Identifiers: Hydrologic data requirements.

Studies in hydrology in the IHD program are reviewed. Interpretation of hydrology and of the role of hydrologists in modern problems, however, must be very liberal, because water cannot be studied realistically independently of other factors in the environment, including biological factors. The ultimate aim of hydrological studies is to aid rational use of water for human purposes. Basic data are essential both for water development and for research. Basic data for all hydrological and related parameters are deficient for huge areas of the world and many development projects are being designed and constructed without an adequate base of data. Modern methods of systems simulation, data reduction, analysis and extrapolation make the apparent deficiencies in some kinds of data much less serious than they were a decade or two ago. New methods for quickly obtaining synoptic and sequential data for large areas also improve the prospects for world hydrology. (Knapp-USGS)
W71-02247

PRINCIPAL PROBLEMS OF MODERN HYDROLOGY,
State Hydrological Inst., Leningrad (USSR).
A. A. Sokolov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 10-19, July 1970. 10 p.

Descriptors: *International Hydrological Decade, *Water balance, *Water resources development, Hydrologic budget, Gaging stations, Hydrogeology, Data collections, Reviews.
Identifiers: USSR.

Water balance studies are being used in the USSR to design reservoir systems on large rivers. For this purpose, 15 hydrometeorological observatories were established. Surface-groundwater relationships, irrigated-land salt balance problems, swamp hydrology, waterlogging of soils, drainage projects, and man's influence on water balance are also studied by the use of hydrologic budget methods. The methods reviewed may be used anywhere, and cooperation between nations in the IHD is intended to help assure their value. (Knapp-USGS)
W71-02248

THE WATER BALANCE OF THE OCEANS,
Main Geophysical Observatory, Leningrad (USSR).
M. I. Budyko.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 24-33, July 1970. 10 p, 2 tab, 30 ref.

Descriptors: *Water balance, *Oceans, Evaporation, Rainfall, Runoff, Hydrologic budget, International Hydrological Decade, Hydrologic cycle.
Identifiers: Oceanic water-balance.

Water exchange over the oceans has a determining influence on the water balance of our planet. Evaporation from the oceans amounts to 90% of the total evaporation from the earth's surface. The accuracy of estimating the components of the water balance of the Earth depends considerably on the accuracy of data on the water balance of the oceans. Several independent methods may be used to calculate precipitation and evaporation: (1) estimation of precipitation using observed data; (2) computation of precipitation; (3) estimation of evaporation without the use of data on radiation balance; (4) estimation of evaporation, taking into account computed radiation balance; and (5) estimation of evaporation, taking into account observed radiation balance. Estimation of evaporation without taking into account the data on radiation balance gives smaller values that seem to be less accurate than the results provided by the other 4 methods. In the World Ocean, estimated precipitation is 114 cm/yr, evaporation is 126 cm/yr, and inflow is 12 cm/yr. The total of precipitation and runoff for the Atlantic Ocean is smaller than the value of evaporation; the Atlantic Ocean receives water from other oceans, including the Arctic Ocean where evaporation is noticeably lower than the total of precipitation and runoff. (Knapp-USGS)
W71-02249

THE SCALE OF OCEANIC INFLUENCE ON CONTINENTAL PRECIPITATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson, and R. F. Lariviere.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 34-39, July 1970. 6 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Precipitation (Atmospheric), *Synoptic analysis, *Climatology, Rainfall, Rainfall disposition, Meteorological data, Regions, Surveys, Weather data, Statistical methods, Hydrologic cycle, Data collections, Correlation analysis.
Identifiers: Continental rainfall distribution, North America.

The serial correlation coefficient of monthly point precipitation at lag one is examined for a common fifty year period at thirty-seven stations spanning the North American continent. The geographical distribution of these coefficients shows significant values along the Pacific (windward) coast which decay Eastward becoming insignificant near the Mississippi River. This is interpreted as defining the spatial scale of maritime influence over precipitation on a windward land mass. (Knapp-USGS)
W71-02250

WATER BALANCE - INDIAN OCEAN,
Physical Research Lab., Ahmedabad (India).
K. R. Ramanathan, and P. R. Pisharoty.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 39-41, July 1970. 3 p.

Descriptors: *Water balance, *Indian Ocean, *Synoptic analysis, *Precipitation (Atmospheric), *Evaporation, Distribution patterns, Hydrologic cycle, Meteorological data, Precipitable water, Weather patterns, Oceans.
Identifiers: India, Water vapor flux.

The Indian Ocean provides the main moisture supply to the Southwest Monsoon, which causes abundant rainfall over India, Burma and Malaya. On the average, the precipitation and the evaporation appear to balance over the whole of the oceanic area on an annual basis. The annual evaporation is in excess of precipitation by more than 100 cm of water over parts of the Arabian Sea; the precipitation is in excess of evaporation by about 80 cm of water over considerable parts of the ocean off the Malayan and Indonesian Coasts. A significant portion of the moisture flux across the west coast of India is derived through evaporation from the Arabian Sea. The supply of water vapor to the Bay of Bengal branch of the Summer Monsoon appears to be derived through a northward flux across the equator east of longitude 70 deg E and through a westward flux across the Burma Malaya-Indonesian complex. Estimates of the net flux of water vapor into the Indian Sub-continent and the total rainfall over the same area, during a week of active monsoon, are respectively 2.06 times 10 to the 16th power and 2.14 times 10 to the 16th power gms per day. They appear to balance reasonably well. (Knapp-USGS)
W71-02251

THE HYDROLOGICAL CYCLE OF GREENLAND AND ANTARCTICA,
McGill Univ., Montreal (Quebec). Dept. of Meteorology.
Svenn Orvig.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 41-49, July 1970. 9 p, 18 ref.

Descriptors: *Water balance, *Hydrologic cycle, *Glaciers, Synoptic analysis, Heat budget, Ablation, Hydrologic budget, Precipitation (Atmospheric), Regimen, Sea level, Water storage, Ice, Storms, Weather patterns.
Identifiers: Ice caps, Greenland, Antarctica.

The great ice caps of Greenland and Antarctica hold most of the 75% of the world's fresh water which is stored as glacier ice. Greenland holds about 2.4 million cu km water and antarctica 20 million cu km. If it all melted, the sea level would be raised about 70 m. The atmosphere holds little water vapor over the ice caps, due to the low temperature. Greenland receives most of its precipitation by upper portions of middle latitude cyclones which often cross the ice cap. In the Antarctic, cyclonic storms seldom penetrate the continent, except for the western part. Precipitation measurements are always difficult in the polar regions, so it is more useful to assess the net water accumulation. The Greenland ice cap balance is negative at present, about 85 cu km water/year. The Antarctic ice budget seems to be positive, with an annual net gain probably around 600 cu km water. Recent times have seen a relatively stable sea level, which indicates that the great ice caps are more or less in equilibrium. Physical-mathematical models can be used to examine the energy and water balances over the snow surfaces. (Knapp-USGS)
W71-02252

SNOW COVER ON THE TERRITORY OF THE USSR AS A WATER BALANCE ELEMENT,
Hydrometeorological Research Center, Moscow (USSR).
V. D. Komarov, and E. G. Popov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 49-54, July 1970. 6 p, 12 ref.

Descriptors: *Hydrologic budget, *Snowpacks, *Surveys, Remote sensing, Streamflow forecasting, Snowmelt, Hydrologic cycle, Heat budget, Reviews, Analytical techniques, Data collections.
Identifiers: USSR.

The influence of snow cover on river water regime and the hydrological cycle of the USSR is reviewed. Climatic conditions vary considerably; while some areas of the country are covered with snow for more than half a year, in other regions snow cover exists for less than a month. Over a major part of the lowland territory snow cover accumulates and remains for a period of 2 to 7 months. The winter average precipitation in the northern parts of the country amounts to 40-50% of the annual volume, in central parts the corresponding figure is about 30%, and in the south, about 15%. Snow cover observations have been conducted since 1892. Airsurvey and satellite surveillance are also used for mountain snow studies. A method of estimating the snowpack water equivalent in plains by means of airsurvey of natural soil gamma-radiation was developed in 1963. The standard error of the measured snowpack water equivalent at a 10 km course ranges from 5 to 7 mm or less than 10%. During the last few years the new method of snow cover survey has been systematically used in a number of river basins (the Volga, the Don, the Dnieper and others). (Knapp-USGS)
W71-02253

LAND GLACIATION PART IN THE EARTH'S WATER BALANCE,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
V. M. Kotlyakov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 54-57, July 1970. 4 p, 1 tab, 9 ref.

Descriptors: *Water balance, *Glaciers, Regimen, Ablation, Melting, Ice, Hydrologic budget, Discharge (Water), Water storage, Antarctic.
Identifiers: Ice caps, Greenland.

The mean duration of water storage on mountain-valley glaciers 10 km long is several hundred years. In the central part of the Antarctic ice sheet, deep layers of ice are 100-200 thousand years old. At present, glaciers cover 16.2 million sq km, about 11% of the land surface. The mean depth of ice is 1700 m and the maximum is in excess of 4000 m in Antarctica. The total volume of glacial ice on the Earth is estimated at 27 million cu km. This is 99% of the ice on our planet. A major portion of the ice is concentrated in Antarctica and Greenland. The remaining glacial regions account for less than 1%, but that comparatively small amount of ice plays an important part in the water balance of the separate regions of the earth. The total ice discharge in Antarctica and Greenland makes up 8% of the Earth's streamflow. Liquid runoff is 330 cu km of water a year and the remaining 280 cu km are solid runoff (iceberg calving). The southern hemisphere icebergs spread to latitude 46-55 deg S., and their total volume in the World Ocean can be estimated at 50% of annual streamflow of the Earth. (Knapp-USGS)
W71-02254

THE ROLE OF UNDERGROUND FLOW IN THE WATER BALANCE OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
B. I. Kudelin, I. S. Zektser, and O. V. Popov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 65-71, July 1970. 7 p, 1 tab, 6 ref.

Descriptors: *Water balance, *Groundwater movement, *Surface-groundwater relationships, Recharge, Discharge (Water), Runoff, Subsurface runoff, Streamflow, Hydrologic budget, Hydrogeology, Surveys.
Identifiers: USSR.

The mean groundwater flow to the rivers of the USSR equals about 24% of total streamflow and 9% of total precipitation. The total value of groundwater flow in the zone of active water exchange is 1,019 cu km per year. About 40% of the total precipitation on the territory of the USSR is discharged to rivers by surface and underground flow and 60% is lost by evaporation and deep underground flow. A short account is given of the main regularities of distribution of normal annual values of the modulus and coefficient of groundwater flow over the whole territory of the USSR and its individual regions. (Knapp-USGS)
W71-02255

EVALUATION OF THE GROUNDWATER BALANCE OF LARGE TERRITORIES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
A. A. Konoplyantsev.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 71-77, July 1970. 7 p, 1 fig, 8 ref.

Descriptors: *Water balance, *Groundwater, Synoptic analysis, Groundwater movement, Water storage, Water levels, Water level fluctuations, Surface-groundwater relationships, Runoff, Aquifers, Recharge, Hydrologic budget, Hydrogeology, Surveys.
Identifiers: USSR, Groundwater budget.

Calculation of the groundwater balance is essential to evaluation of the total water balance of large territories. To evaluate groundwater balance observation records of the groundwater regime, theoretically well-founded information of the change in the groundwater regime in area (in space) and cartographic measurement of changes in the groundwater balance on the territory are required. A good deal of work has already been done in this direction. These problems and studies are briefly reviewed. (Knapp-USGS)
W71-02256

ON THE ROLE OF UNDERGROUND STORAGE IN THE SETTING UP OF THE WATER BALANCE (FRENCH),
Gilbert Castany.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 78-83, July 1970. 6 p, 2 fig, 2 tab.

Descriptors: *Water balance, *Water storage, *Aquifers, *Hydrogeology, Rainfall-runoff relationships, Recharge, Infiltration, Groundwater movement, Hydrologic cycle, Discharge (Water), Evapotranspiration, Soil water movement, Hydrologic budget.
Identifiers: Groundwater budget.

Groundwater storage plays an important quantitative and qualitative part in mainland water balance. The characteristics of the ground surface regulate the rainwater distribution into runoff and infiltration. The natural retention ability of the aquifer provides temporary storage, which partly regulates flow rates. A bulk of water, which is not entirely negligible, is regularized by storage underground. This storage period is often longer than the reference period used for the statistical analysis of basic data. Hydrogeology must be considered in any areal water balance study. (Knapp-USGS)
W71-02257

APPLICATION OF THE SSARR MODEL TO A BASIN WITHOUT DISCHARGE RECORD,
Weather Bureau, Salt Lake City, Utah. Western Region.
Vail Schermerhorn, and Donald W. Kuehl.
Available from NTIS as PB-194 394, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum WBTM WR55, August 1970. 7 fig, 7 ref.
Identifiers: *Hydrology, Models, *Flood forecasting, Washington (State), Watersheds, Rainfall, Snowmelt, Surface water runoff, Soil water, Stream flow, Simulation, Computer programming, SSARR (Streamflow Synthesis and Reservoir Regulation), Skokumchuck River.

Hydrologic models are usually designed and tested on basins where high quality data are available with adequate areal and time coverage. In operational forecasting the model must be applied where the forecast is needed and not necessarily where all desired data are available. The SSARR (Streamflow Synthesis and Reservoir Regulation) model was designed to be a general, flexible model with special provisions for use in daily river forecasting operations. In the present application, the model is used to answer a need for flood forecast service on the Skookumchuck River at Centralia, Washington. Streamflow data consist of short period gage height records, but no discharge information except for smaller headwater areas. Precipitation must be estimated from two stations in an adjacent watershed.
W71-02297

FACTORS CONTRIBUTING TO UNUSUALLY LOW RUNOFF DURING THE PERIOD 1962-68 IN THE CONCHO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W71-02448

A SURVEY OF WATER BALANCE PROBLEMS, PROJECTS AND PROGRESS IN ALBERTA,
Meteorological Service of Canada, Calgary (Alberta). Watershed Research Program.
D. Storr.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 314-324, July 1970. 11 p, 2 fig, 18 ref.

Descriptors: *Water balance, *Synoptic analysis, *Project purposes, *International Hydrological Decade, Hydrologic budget, Hydrologic cycle, Reviews, Meteorology, Topography, Precipitation (Atmospheric), Runoff, Vegetation, Water storage, Evapotranspiration, Climatic data, Streamflow.
Identifiers: *Alberta (Canada).

Projects concerning water balance problems in Alberta, Canada are evaluated. Although termed one of the 'Prairie Povinces', less than 15% of the area can be called prairie. North of latitude 55 degrees most of the area is forest, lake, and swamp with only small enclaves of agricultural land. Similarly, the Rocky Mountains with heights up to 12,000 feet and their forested foothills remove a large portion of the southwest from the prairie classification. Human habitation, and hence hydrologic observation, is confined mainly to the agricultural area as there are only pockets of settlement in the northern forests and the mountain valleys. Most settlement has occurred since 1900 so the history of the hydrologic sciences in Alberta is quite limited. In the hydrologic sense, Alberta could therefore be classed with the 'developing countries'. Estimating precipitation, surface runoff, evapotranspiration and storage changes for such a nonhomogeneous area presents many problems. The achievement of a provincial water balance is hindered by large gaps in knowledge of basic hydrologic parameters. If a balance could be achieved by each of the ten I.H.D. projects considered, the relationships obtained would promote the achievement of a balance on the provincial scale. (Woodard-USGS)
W71-02458

WATER-BALANCE IN THE FEDERAL REPUBLIC OF GERMANY,
Freiburg Univ. (West Germany).
Reiner Keller.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 300-314, July 1970. 15 p, 6 fig, 1 tab, 14 ref.

Descriptors: *Water balance, *Foreign projects, Hydrologic cycle, Evapotranspiration, Precipitation (Atmospheric), Hydrologic budget, Meteorology, Surface waters, Synoptic analysis, Equations, Vegetation, Groundwater, Runoff, Water storage, Solar radiation, Soil properties, International Hydrological Decade.
Identifiers: *Federal Republic of Germany.

The calculation of the plan of water balance is divided into four steps: (1) Determination of the mean precipitation; (2) estimation of transpiration according to a special procedure and determination of evapotranspiration; (3) the total run-off obtained from the difference between recorded precipitation and calculated evapotranspiration; and (4) water demands of industry and municipalities. In the interpretation of the water-balance in the Federal Republic of Germany there are various conceptions which touch upon hypotheses and problems of ecological regional investigations. The close correlation between the ecological potential of a region and water-consumption, or evapotranspiration is controlled by the balance of radiation and soil characteristics. (Woodard-USGS)
W71-02459

METHODS FOR THE COMPUTATION OF WATER BALANCE OF RESERVOIRS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 07C.
W71-02460

GENERAL SCHEME FOR CALCULATING THE WATER BALANCE OF CLOSED INLAND SEAS AND LAKES BY THE METHOD OF STATISTICAL MODELLING,
Georgian Power Research Inst., Tiflis (USSR).
For primary bibliographic entry see Field 02H.
W71-02461

STORAGE IN THE WATER BALANCE OF THE LAKE ONTARIO BASIN,
Department of Energy, Mines and Resources, Cornwall (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02H.
W71-02462

METHODS FOR COMPILATION OF CURRENT WATER BALANCES OF RIVER DRAINAGE BASINS IN THE USSR,
State Hydrological Inst., Leningrad (USSR).
A. P. Bochkov, and A. B. Zavodchikov.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 274-280, July 1970. 7 p, 1 tab, 5 ref.

Descriptors: *Water balance, *Methodology, *Watersheds (Basins), Mathematical studies, Equations, Hydrologic cycle, Meteorology, Hydrologic budget, Synoptic analysis, Streamflow, Vegetation, Evapotranspiration, Water storage, Precipitation (Atmospheric), Groundwater, Surface waters, Soil water movement, Runoff, International Hydrological Decade.
Identifiers: *USSR.

In Russia water balances are computed for each month, season, and year for about 200 river basins including both large river systems and small experimental watersheds. However, due to the fact that the number of observation points for measuring various water balance components is not sufficient, computation of water balance for big rivers is performed by means of a simplified water-balance equation. Methods and examples of water balance computations are presented. (Woodard-USGS)
W71-02463

VERTICALLY DIFFERENTIATED WATER BALANCE IN TROPICAL HIGH MOUNTAINS - WITH SPECIAL REFERENCE TO THE SIERRA NEVADA DE SANTA MARTA/COLOMBIA,
Reimer Herrmann.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 262-273, July 1970. 12 p, 3 fig, 15 ref.

Descriptors: *Water balance, *Mountains, *Tropical regions, Hydrologic budget, Hydrologic cycle, Precipitation (Atmospheric), Soil moisture, Soil water movement, Evaporation, Runoff, Rainfall, Vegetation, Forests, Meteorology, Evapotranspiration, Slopes, Streamflow, Watersheds (Basins), Synoptic analysis, International Hydrological Decade.
Identifiers: *Columbia (South America).

The hydrological vertical zonation of tropical high mountains depends on their situation within the general circulation and on climatic differentiation caused by local exposure. Thus a variety of different hydrological altitudinal zones exists. The lee type sequence of the trade wind zone is explained using the northwestern Sierra Nevada de Santa Marta/Colombia as an example. The Sierra climbs steeply direct from sea level to a height of approx. 6000 m. The profile begins with the region of the driest climate on the Caribbean coast. This dry climate is caused by dry, hot katabatic winds (R. Herrmann 1970b), stress-differential induced divergence (R.A. Bryson and P.M. Kuhn 1961) and leeside divergence (F. Lahey 1958). As the dry katabatic winds are limited to the coastal heights and the floodplain of the Rio Gaira in the profile, and as at growing distance from the coast the stress-differential induced divergence and the leeside divergence diminish, there develops strong slope convergence connected with higher tendency for rainfall. By means of the least square method the vertical variation of rainfall may be described making it easy to find the height of maximum rainfall at 1660 m. But above this in the zone of tropical ombriphilous cloud forest there is additional rainfall by fog drip, which indicates that the hydrological effective maximum may be at a height of about 2300 m. The whole survey was made among natural plant formations or among secondary plant formations similar to the natural ones. The vertical zonation of the water balance follows the vertical zonation of plant formations beginning at sea level. The soil moisture pressure dynamics are explained by means of isopleths. (Woodard-USGS)
W71-02464

COMMENTS ON WATER BUDGET INVESTIGATIONS, ESPECIALLY IN TROPICAL AND SUBTROPICAL MOUNTAIN REGIONS,
Bonn Univ. (West Germany).
H. Flohn.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 251-262, July 1970. 12 p, 4 fig, 2 tab, 26 ref.

Descriptors: *Water budget, *Mountains, *Subtropic, *Tropical regions, Water balance, Hydrologic budget, Hydrologic cycle, Water vapor, Streamflow, Runoff, Model studies, Equations, Precipitation (Atmospheric), Valleys, Meteorology, Synoptic analysis, International Hydrological Decade.
Identifiers: *Surface energy, South America, Africa, Southern Asia.

Three different techniques are used to evaluate the water budget of a given area: hydrological balance, surface energy budget, and evaluation of the divergence of the atmospheric water vapor transport. Due to deficiencies of available observations, relatively large systematic and random errors are unavoidable and necessitate the comparative (and critical) use of different techniques. In tropical and subtropical mountains local daytime circulations lead to a systematic underestimate of rainfall measured at most valley stations. In contrast to the daytime circulations, the effect of the reversed nighttime circulations on the precipitation pattern is much more infrequent. Some examples are demonstrated. (Woodard-USGS)
W71-02465

MEANING OF WATER BALANCE IN WARM HUMID ISLANDS,
National Research Center for Disaster Prevention, Tokyo (Japan).
M. Sugawara.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 243-250, July 1970. 8 p, 6 fig, 1 tab.

Descriptors: *Water balance, Humid areas, *Hydrologic cycle, Hydrologic budget, Floods, Meteorology, Streamflow, Model studies, Rainfall, Runoff, Water resources, Evaporation, Synoptic analysis, International Hydrological Decade, Foreign projects.
Identifiers: *Japan.

Annual precipitation is much greater than annual evapotranspiration on Japan's warm humid islands. Heavy storms and floods are frequent. Therefore, if we make a balance sheet of water, large errors may be on both sides, one from the heavy storm another from the flood. A way of avoiding this defect is to classify the precipitation and the discharge by their quantities. Then heavy storms may correspond mainly to floods and their large errors cancel each other. This classification merely by the quantity has some defects, because it does not contain the concept of time. One way to consider the effect of time is to classify the precipitation by runoff models. This method is especially important in humid regions where the greater part of precipitation turns into surface discharge. Classification of precipitation and discharge is important not only for avoiding the errors as described, but also for the water use. (Woodard-USGS)
W71-02466

EVALUATION OF RESOURCES OF SHALLOW AQUIFIERS (IN FRENCH),
R. Degallier, and C. Joseph.
English, Spanish and Russian abstracts. In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 84-99, July 1970. 16 p, 5 plate, 1 tab, 5 ref.

Descriptors: *Water levels, *Water level fluctuations, *Water balance, *Groundwater, *Computer programs, Rainfall, Surface-groundwater relation-

ships, Hydrologic cycle, Antecedent precipitation, Infiltration, Aquifers, Mathematical models, Water storage.
Identifiers: Rainfall-recharge relationships.

Excellent correlations have been obtained between rainfall cumulative departure curves and ground water levels, in climates as different as those of Sahara, equatorial forest, African savannah and France. The rainfall function may include a phase-shifting module simulating the time for transfer through the soil, a threshold module excluding the small showers in periods of soil moisture deficit, a subroutine stopping the correlation when the water table has reached the soil surface, and a possibility of taking into account either increasing or decreasing water levels. Applications of the method are shown and a FORTRAN computation program is appended. This method can help to predict groundwater level fluctuations and can compare groundwater recharge over long distances. (Knapp-USGS)
W71-02467

WATER RESOURCES RESEARCH IN MINNESOTA BY THE NORTH CENTRAL FOREST EXPERIMENT STATION,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Roger R. Bay.
Proc Conference on Ongoing Water Resources Research in Minnesota, March 1970. Univ of Minn. Water Resources Research Center Bul 21, p 40-56, June 1970.

Descriptors: *Bogs, *Organic soils, *Peat, *Minnesota, *Wetlands, Swamps, Demonstration watersheds, Streamflow, Forestry, Groundwater, Evapotranspiration, Soil physical properties, Water table, Water yield improvement.
Identifiers: *Peatlands, *Wetland hydrology, *Experimental watersheds, Forest hydrology, Watershed management research.

Describes general research in peatland hydrology conducted by the U.S. Forest Service in northern Minnesota. Experimental watershed studies on individual peat bog basins are concerned with water quantity and water quality from natural bog areas and as influenced by forestry practices. Other studies include the relationship between local groundwater systems and bog water tables, the investigation of physical and hydrologic properties of organic soils, and evapotranspiration and energy balance measurements on various bog vegetation systems. (Bay-Forest Service)
W71-02750

2B. Precipitation

THE SCALE OF OCEANIC INFLUENCE ON CONTINENTAL PRECIPITATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-02250

WATER BALANCE - INDIAN OCEAN,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 02A.
W71-02251

AREAL COVERAGE OF PRECIPITATION IN NORTHWESTERN UTAH,
Weather Bureau, Salt Lake City, Utah. Western Region.
Philip Williams, Jr., and Werner J. Heck.
Available from NTIS as PB-194 389, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum WBTM WR56, Sept. 1970. 20 p, 8 tab, 5 fig, 3 ref.
Identifiers: *Atmospheric precipitation, *Utah, Probability, Networks, Weather forecasting, Periodic variations, Weather stations, Accuracy.

Areal coverage of precipitation in a dry region, such as northwestern Utah would be expected to be lower than in a moist area like Kentucky. This small areal coverage would have a marked effect on the degree to which Salt Lake City PoP forecasts could improve over climatological forecasts. The purposes of this study are to determine: (1) the frequency distribution of areal coverage on percipitation days in northwestern Utah during various seasons of the year, and (2) the maximum possible improvement of forecast Brier Scores over climate Brier scores.
W71-02298

GROUND RAINFALL DATA FOR THE 1968 FLORIDA CLOUD SEEDING EXPERIMENT,
Environmental Data Service, Silver Spring, Md.
For primary bibliographic entry see Field 03B.
W71-02301

SNOWFALL, SNOWFALL FREQUENCIES, AND SNOW COVER DATA FOR NEW ENGLAND,
Environmental Data Service, Silver Spring, Md.
R. E. Lautzenheiser.
Available from NTIS as PB-194 221, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum EDSTM 12, December 1969. 15 p, 2 tab, 8 fig.

Descriptors:
Identifiers: *Snowfall, Statistical data, *Snow cover, Seasonal variations, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island.

Seasonal total snowfall averages and extremes, frequencies of various snowfall intensities from 1 to 8 inches in a day, and snow cover data are presented in a series of 8 maps and 2 tables. Some notes on difficulties in obtaining good snowfall data are included. Nearly 100 stations were studied for snowfall frequency and snow cover data, using around 30 years of record per station if available. None with less than 10 years of record were used. Results show a several-fold increase in seasonal snowfall, in days with 1 inch or more of snowfall, and in maximum snow cover depth, from the southeastern coastal area to the north and to higher elevations. Frequencies of heavy snowfalls, of 8 inches or more in a day, however, are more uniform over New England, averaging mostly once or twice a year. The monthly distribution of 1 and 4 inch daily snowfalls are shown.
W71-02303

A STUDY OF THE PRODUCTION AND DETECTION OF ARTIFICIAL ICE NUCLEI,
Denver Research Inst., Colo.
For primary bibliographic entry see Field 03B.
W71-02304

VERTICALLY DIFFERENTIATED WATER BALANCE IN TROPICAL HIGH MOUNTAINS - WITH SPECIAL REFERENCE TO THE SIERRA NEVADA DE SANTA MARTA/COLOMBIA,
For primary bibliographic entry see Field 02A.
W71-02464

COMMENTS ON WATER BUDGET INVESTIGATIONS, ESPECIALLY IN TROPICAL AND SUBTROPICAL MOUNTAIN REGIONS,
Bonn Univ. (West Germany).
For primary bibliographic entry see Field 02A.
W71-02465

MEANING OF WATER BALANCE IN WARM HUMID ISLANDS,
National Research Center for Disaster Prevention, Tokyo (Japan).
For primary bibliographic entry see Field 02A.
W71-02466

CALCULATION OF PRECIPITABLE WATER,
Weather Bureau, Silver Spring, Md. Technique Development Lab.
L. P. Harrison.
Available from NTIS as PB-193 600, $3.00 i paper copy, $0.95 in microfiche. Essa Technica Memorandum WBTM TDL 33, June 1970. 61 p, fig, 3 tab, 118 ref.
Identifiers: *Atmospheric precipitation, Measure ment, Radiosondes, Water vapor, Boundary valu problems, Dew point, Humidity.

Two methods of calculating precipitable water ar given in terms of data obtainable from a radiosond or rawinsonde observation. Method I is based o the premise that aqueous vapor pressure (or dev point) and temperature are reported for deter mined geopotential levels or geometric altitude with reference to mean sea level; while Method II i predicated on the basis that aqueous vapor pres sure (or dew point) is reported for respectiv specified barometric pressure levels whos geopotentials are computed by means of the dat obtained in the sounding. Thus, under Method I th precipitable water is calculated by numerical in tegration such that the variable of integration i either geopotential or geometric altitude, an under Method II it is calculated by such procedure that the variable of integration is pres sure. In either case one may choose to assume ar bitrarily that the acceleration of gravity g is cor stant, thus implicitly giving rise to a small syste matic error; or one may treat the problem in a mor accurate manner by taking g as a known function o latitude and geopotential (or geometric altitude Procedures covering all of these alternatives ar presented.
W71-02608

2C. Snow, Ice, and Frost

THE HYDROLOGICAL CYCLE OF GREEN LAND AND ANTARCTICA,
McGill Univ., Montreal (Quebec). Dept. o Meteorology.
For primary bibliographic entry see Field 02A.
W71-02252

SNOW COVER ON THE TERRITORY OF TH USSR AS A WATER BALANCE ELEMENT,
Hydrometeorological Research Center, Mosco (USSR).
For primary bibliographic entry see Field 02A.
W71-02253

LAND GLACIATION PART IN THE EARTH' WATER BALANCE,
Akademiya Nauk SSSR, Moscow. Institu Geografii.
For primary bibliographic entry see Field 02A.
W71-02254

2D. Evaporation and Transpiratio

THE WATER BALANCE OF THE OCEANS,
Main Geophysical Observatory, Leningra (USSR).
For primary bibliographic entry see Field 02A.
W71-02249

ATMOSPHERIC-AND SOIL-INDUCED WATE STRESSES IN PLANTS AND THEIR EFFECT ON TRANSPIRATION AND PHOTOSYNTHES IS,
Agricultural Research Service, Phoenix, Ari Water Conservation Lab.
S. B. Idso.
Journal of Theoretical Biology, Vol 21, p 1-1 1968. 9 fig, 11 ref.

Descriptors: *Photosynthesis, *Transpiratio *Moisture stress, *Humidity, *Soil-water-plan

relationships, Soil water, Irrigation practices, Free energy, Leaves, Thermodynamic behavior, Soil structure, Soil properties, Theoretical analysis, Root systems, Moisture tension, Atmosphere, Soil physical properties, Vapor pressure, Moisture deficit, Rates of application.
Identifiers: *Diffusion pressure deficit (DPD), *Water potential, Chloroplasts, Evaporative demand.

It is proposed that the general phenomenon of 'water stress' is composed of 2 nearly independent phenomena involving photosynthesis and transpiration. Developing appropriate theoretical considerations, it is shown that plant diffusion pressure deficit (DPD) may be lowered by a maximum of only 2 atm by increasing relative humidity (or decreasing evaporative demand) from 40-98%. Alternatively, photosynthesis, which is a function of the absolute free energy of water in the vicinity of chloroplasts, varies from 0-23 atm DPD, which may be traversed by changing the free energy of the soil moisture from 0 to 2 or 3 atm. From these and similar considerations, it is concluded that photosynthesis is 90% decoupled from atmospheric moisture and transpiration is independent of soil moisture to a similar degree. It is then shown from the data of various workers that, owing to these differing stress factors, photosynthetic rates may increase in response to water applications that have already effected maximum transpiration rates. These ideas are discussed as factors in irrigation practices and it is felt that in certain situations where other factors, such as soil properties and light intensity are favorable, repeated water applications beyond maximum transpiration levels may result in higher irrigation yields. (Casey-Arizona)
W71-02508

INTRASPECIFIC DIFFERENCES IN TEMPERATURE-INDUCED RESPIRATORY ACCLIMATION OF DESERT SALTBUSH,
California Univ., Riverside. Dept. of Agronomy.
N. J. Chatterton, C. M. McKell, and B. R. Strain.
Ecology, Vol 51, No 3, p 545-547, Late Spring 1970. 3 fig, 1 tab, 9 ref. NSF Grant GB-7230.

Descriptors: *Xerophytes, *Respiration, *Carbon dioxide, *Ecotypes, *Environmental effects, Acclimitization, Cold resistance, Physiological ecology, Photosynthesis, Laboratory tests, California, Arizona, Temperature, Heat resistance, Metabolism, Plant growth, Plant physiology, Mode of action, Southwest U.S., Arid lands, Desert plants, Fluctuation.
Identifiers: *Saltbush, *Gas exchange, *Plant adaptations.

High temperatures during growth in plants result in higher photosynthesis temperature optima than when grown at lower temperatures. This is thought to be a multiple biochemical mechanism somatic tissue adaptation which facilitates organismic compensation for seasonal environmental fluctuations. It is unclear to what extent this adaption is controlled by genetic properties. The desert saltbush (Atriplex polycarpa) is distributed widely in southwestern deserts of differing mean annual temperatures. Plants were grown from seeds of 3 isolated populations from areas of differing mean temperature and preconditioned in 3 temperature regimes (5-16 deg. C., 21-32 deg. C. and 32-43 deg. C.). Dark respiration as measured by carbon dioxide evolution was determined in each temperature range (5, 10, 25 and 40 deg. C.). Results indicated that plants from warm areas had less capacity to adapt to cold temperatures than plants from cold areas. This suggests intraspecific differences in acclimation potential. (Casey-Arizona)
W71-02514

TRITIUM COLLECTION AND EXTRACTION TECHNIQUES FOR PLANT-WATER RELATIONSHIP STUDIES,
Texas A and M Univ., College Station. Dept. of Range Science.
S. E. Young, J. D. Dodd, and E. R. Ibert.
Ecology, Vol 51, No 3, p 535-537, Late Spring 1970. 3 fig, 10 ref. AEC Contract No AT- (40-1)-3488.

Descriptors: *Tritium, *Radioactivity techniques, *Laboratory equipment, *Transpiration, *Cacti, Xerophytes, Vacuum drying, Quenching, Tracers, Freeze drying, Water balance, Water vapor, Water loss, Vapor pressure, Plant tissues, Analytical techniques, Water circulation.
Identifiers: *Hygrothermographs, *Vapor pressure deficit, Plant-water relationships, Combustion.

The advantages of tritium as a plant-water tracer are outlined. Tracer techniques were developed for measuring water movement and water loss in the pricklypear cactus (Opuntia spp.). Plants were injected with tritiated water of varying specific activities. Transpired vapor was collected by using a vacuum pump to pass dry air over the plant surface and into collecting vials. Hygrothermograph recordings were used to determine vapor pressure deficit values. Tissue water was extracted by freeze-drying in cold water and by warm water. Combustion values obtained indicated this tracer technique is effective when extraction time is 8 hrs. With slight equipment modifications, the technique should be applicable to other plant species. (Casey-Arizona)
W71-02516

2E. Streamflow and Runoff

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Edward A. McBean, and Frank E. Perkins.
Available from NTIS as PB-196 120, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Institute of Technology Hydrodynamics Laboratory Report No 124, June 1970. 167 p, 25 fig, 20 tab, 25 ref, 3 append. OWRR Project C-1495 (No 1988), (3).

Descriptors: *Mathematical studies, *Streamflow, *Flow profiles, *Water levels, *Stage-discharge relations, Data processing, Equations, Mathematical models, Computer programs, Numerical analysis, Programming languages, Mannings equation, Channel morphology, Supercritical flow, Turbulent flow, Profiles.
Identifiers: *Error calculations, *Backwater profiles.

Numerical error generation properties and the effects of data uncertainty are analyzed for several of the most common methods used in water surface profile computations. Theoretical equations are developed that serve as bounds on the actual errors that are introduced during the computation. The analysis also provides criteria which may be used in the rational selection of the calculation increment. In most engineering applications the effect of numerical errors on the computed profile will be considerably smaller than that due to data uncertainty. When numerical error generation is significant, it is predictable through the error bound equations. The successive substitutions algorithm, presently used in most computer programs for convergence of the iteration scheme, sometimes encounters difficulties due to convergence to incorrect profiles and failure to converge; application of the bisection algorithm eliminates these problems. (Knapp-USGS)
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
Daniel J. Gunaratnam, and Frank E. Perkins.
Available from NTIS as PB-196 159, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Institute of Technology Hydrodynamics Laboratory Report No 127, July 1970. 259 p, 76 fig, 11 tab, 42 ref, 4 append. OWRR Project C-1495 (No 1988), (2).

Descriptors: *Routing, *Computer programs, *Open channel flow, *Unsteady flow, *Equations, Streamflow forecasting, Water storage, Flood forecasting, Runoff forecasting, Linear programming, Waves (Water), Tides, Bores, Tidal effects, Hydraulic models.
Identifiers: *Unsteady open channel flow.

A finite difference scheme was developed to integrate the St. Venant Equations over a wide range of transient flow conditions. The scheme was incorporated into a useful computer program. Systematic testing compared the difference scheme with observed data and linearized analytical solutions. The weighted residual method using the Galerikan technique of minimizing proved to be a relatively simple method for deriving a minimum error finite difference scheme. Solution of the set of simultaneous algebraic equations generated by the implicit difference scheme was effected using the influence function method. This provides a very efficient procedure for solving the equations associated with a network of channels. (Knapp-USGS)
W71-02202

PHOTOMICROSCOPIC SUBLAYER VELOCITY MEASUREMENT,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02206

IMPLICIT FLOOD ROUTING IN NATURAL CHANNELS,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and Virginia Inst. of Marine Science, Gloucester Point.
Michael Amein, and Ching S. Fang.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7773, p 2481-2500, December 1970. 20 p, 10 fig, 1 tab, 24 ref, append. OWRR Project A-001-NC.

Descriptors: *Flood routing, *Computer programs, *Open channel flow, *Unsteady flow, Mathematical models, Numerical analysis, Digital computers, Floods, Channel morphology, Linear programming.
Identifiers: Implicit flood-routing methods.

Flood routing and many other applications in hydraulic engineering are based on the solution of the equations of unsteady flow and require fast and accurate numerical methods. An implicit numerical method which is both fast and accurate can be established on the basis of: (1) A centered difference scheme to represent the primary differential equations in finite difference form; and (2) the simultaneous solution of the finite difference equations for each time step. The difference equations constitute a system of nonlinear algebraic equations which can be solved on a digital computer by Newton iteration method. The computational scheme becomes very efficient when advantage is taken of the sparseness of the matrix of coefficients of the linear systems employed in the iteration. Applications of the implicit method show that it can be conveniently used for highly irregular channels. (Knapp-USGS)
W71-02207

WATER RESOURCES DATA FOR COLORADO 1969: PART 1. SURFACE WATER RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 07C.
W71-02246

HYDROGEOLOGIC DATA FOR THE SOUTHWESTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.

Mendall Thomas, Robert B. Ryder, and Chester E. Thomas, Jr.
Connecticut Water Resources Bulletin No 18, 1969. 45 p, 2 fig, 1 plate, 8 tab, 16 ref.

Descriptors: *Water resources, *Water quality, *Hydrologic data, *Connecticut, Surface waters, Groundwater, Chemical analysis, Observation wells, Water levels, Streamflow, Flow rates, Precipitation (Atmospheric), Lakes, Reservoirs, Data collections, Hydrogeology.
Identifiers: *Basic data.

Hydrologic and geologic data collected by the U.S. Geological Survey during an investigation of water resources in cooperation with the Connecticut Water Resources Commission is presented. These basins occupy about 394 square miles in Connecticut and 46 square miles in New York, including the towns of Greenwich, Stamford, Darien, New Canaan, Norwalk, Wilton, Westport, Weston, Fairfield, Easton, and Bridgeport, and parts of Danbury, Ridgefield, Redding, Bethel, Newtown, Trumbull, Monroe, Shelton, and Stratford. The data include records of 391 wells, graphical logs of 144 wells and 319 test holes, laboratory analyses of the grain size of 39 samples of stratified drift, and data from 5 pumping tests. Partial records of streamflow were collected at 19 gaging stations. At these gaging stations, from 1 to 18 discharge measurements and from 1 to 40 stage measurements were made during the period September 1960 to September 1965. From stage-discharge relationships based upon the discharge measurements, discharges were determined corresponding to the stages measured. A list of discharge determinations for all partial-record gaging stations is included, and chemical quality analyses are tabulated. (See also W71-01912). (Woodard-USGS)
W71-02259

FLOOD PLAIN INFORMATION, CITY OF ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA, FOURMILE RUN.
Corps of Engineers, Baltimore, Maryland.
For primary bibliographic entry see Field 04A.
W71-02285

FOUR-POINT METHOD OF CHARACTERISTICS,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-02431

PERIODIC PERMANENT ROLL WAVES,
California Univ., Irvine. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-02432

COMPUTATION OF OPEN-CHANNEL SURGES AND SHOCKS,
Thessaloniki Univ., Salonika (Greece). School of Agriculture; and California Univ., Davis. Dept. of Water Science.
George Terzidis, and Theodor Strelkoff.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7780, p 2581-2610, December 1970. 30 p, 16 fig, 32 ref, append. OWRR Project B-037-CAL.

Descriptors: *Surges, *Bores, *Unsteady flow, *Supercritical flow, Mathematical models, Hydraulic models, Open channel flow, Waves (Water), Computer models, Hydraulic jump.
Identifiers: *Open channel shocks, Method of characteristics.

Unsteady flows in fixed-bed open channels are computed on the basis of the same assumptions as those for steady, gradually varied flow, the key one being hydrostatic pressure distribution in every cross section. The St. Venant equations for this case commonly are solved either by the method of characteristics or by finite differences in a rectangular network. Positive waves are characterized by converging characteristics; once these intersect a bore or shock forms, and many customary methods of solution fail. The equations of motion for flow with and without shocks are compared, the generation of bores is analyzed by exact solution of characteristic equations, and several numerical schemes are presented for through-computation of unsteady flows that may contain shock zones. Comparison is made between computed results and experimental data gathered for a variety of cases; corroboration is generally good. (Knapp-USGS)
W71-02433

POTAMOLOGY DATA COLLECTION ON LOWER MISSISSIPPI RIVER,
Army Engineer District, Vicksburg, Miss. River Stabilization Branch.
Charles M. Elliott.
ASCE Proceedings, Journal of the Waterways, Harbors and Coastal Engineering Division, Vol 96, No WW3, Paper 7466, p 601-622, August 1970. 22 p, 14 fig, 4 ref.

Descriptors: *Data collections, *Hydrologic data, *Potamology, *Mississippi River, Sediment transport, Sedimentary structures, Channel morphology, River training, Flood control, Hydrography, Navigation, Surveys, Stream gages, Gaging stations.
Identifiers: *Potamology data.

The potamology data collection program of the U. S. Army Corps of Engineers, Vicksburg District, is designed to provide adequate, dependable data on the behavior of the Lower Mississippi River. The data are being used to establish guidelines for effectively and economically stabilizing the river for flood control and navigation. Channel stabilization problems involve not only the most feasible means of stabilizing specific reaches of the river, but also long-range predictions of natural and man-caused changes in river regime. The data being collected are hydrographic surveys, bed form profiles, current direction, discharge and horizontal velocity distribution, bed material and suspended sediment samples, and water surface profiles. Emphasis is placed on standardized data documentation in order to minimize the amount of time necessary to prepare the data for study and to enable personnel who are relatively unfamiliar with the details of the program to use the data confidently. (Knapp-USGS)
W71-02438

FACTORS CONTRIBUTING TO UNUSUALLY LOW RUNOFF DURING THE PERIOD 1962-68 IN THE CONCHO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
Stanley P. Sauer.
Geological Survey Open-file Report (Texas Dist Rep No 112), August 1970. 85 p, 29 fig, 16 tab, 26 ref.

Descriptors: *Droughts, *Runoff, *Low flow, *Evaluation, *Texas, Hydrologic data, Surface waters, Streamflow, Flow rates, Water yield, Consumptive use, Vegetation, Rainfall-runoff relationships, Climatology, Topography, Maps, Hydrographs, Statistical methods, Groundwater, Groundwater movement.
Identifiers: *Concho River basin (Tex).

To determine the reasons for the unusually low runoff in the Concho River basin during the period 1962-68, the physical developments and climatic changes in the basin were identified and related to changes in the regimen of streamflow. Land use, brush infestation, and land-treatment practices have not caused significant changes in the rainfall-runoff relationship. The use of surface-water for irrigation has increased very little during the past 70 years, and although the use of groundwater for irrigation has greatly increased in the past 25 years, springflow has not been significantly diminished. The base flow of the streams is materially reduced by surface-water irrigation diversions. Diversions for municipal and industrial use have increased rapidly, but these diversions affect only the streamflow downstream from San Angelo. The analyses of rainfall-intensity and runoff data indicate that the basic cause for the relatively low runoff during the period 1962-68 was the lack of high-intensity long-duration storms. Coefficients of variation ranged from 0.8 to 1.4, and first-order serial correlations ranged from 0.01 to 0.28. Drought recurrence interval of the report period is about 200 years. (Woodard-USGS)
W71-02448

WATER-RESOURCES INVENTORY SPRING 1968 TO SPRING 1969--ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
William R. Powers, III.
Geological Survey Open-file Report, July 1970. 15 p, 8 fig, 3 tab, 2 ref.

Descriptors: *Water resources, *Semiarid climates, *California, Groundwater, Surface waters, Rainfall, Runoff, Evaporation, Data collections, Water table, Aquifers, Water yield, Streamflow, Flow rates, Meteorological data, Hydrologic data, Climatic data, Hydrographs.
Identifiers: Mojave Desert region (Calif), *Water inventory.

This is the third annual report prepared by the U.S. Geological Survey in cooperation with the Antelope Valley-East Kern Water Agency (AVEK) to assist the agency in its program of basin management. As part of that program, streamflow, precipitation, evaporation, and groundwater data are being collected on a continuing basis by the U.S. Geological Survey. These hydrologic data are being analyzed annually. The AVEK area is about 35 miles north of Los Angeles, Calif., in the southwestern part of the Mojave Desert region, covering part of the northeastern section of Los Angeles County and part of the southeastern part of Kern County. The AVEK area is in the area of Lancaster, Mojave, and Palmdale. Precipitation, evaporation, streamflow, and groundwater levels analyzed from spring 1968 to spring 1969 show that precipitation and runoff were below normal, evaporation was about normal, and water levels continued to decline at about the same rate as in the past--about 8 feet per year in the area of maximum decline. (Woodard-USGS)
W71-02455

BIBLIOGRAPHY OF MONTANA WATER RESOURCES AND RELATED PUBLICATIONS.
Montana Water Resources Board, Helena.
For primary bibliographic entry see Field 10.
W71-02469

PRELIMINARY INVENTORY OF THE WATER RESOURCES OF IDAHO.
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 07C.
W71-02471

DISCUSSION OF 'MECHANICS OF CONDENSER WATER DISCHARGE FROM THERMAL POWER PLANTS' BY D. R. HARLEMAN,
California Inst. of Tech., Pasadena. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W71-02483

MODELING OF HEATED WATER DISCHARGES,
Hydraulic Research Station, Wallingford (England).
For primary bibliographic entry see Field 05B.
W71-02484

DISCUSSION OF 'MODELING OF HEATED DISCHARGES' BY PETER ACKERS,
Tennessee Valley Authority, Norris. Engineering Lab.
For primary bibliographic entry see Field 05B.
W71-02485

2F. Groundwater

THE ROLE OF UNDERGROUND FLOW IN THE WATER BALANCE OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02255

EVALUATION OF THE GROUNDWATER BALANCE OF LARGE TERRITORIES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02A.
W71-02256

ON THE ROLE OF UNDERGROUND STORAGE IN THE SETTING UP OF THE WATER BALANCE (FRENCH),
For primary bibliographic entry see Field 02A.
W71-02257

HYDROGEOLOGIC DATA FOR THE SOUTHWESTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-02259

HYDRODYNAMICS OF FLOW IN POROUS MEDIA,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 04A.
W71-02260

A CONTRIBUTION TO THE SOLUTION OF GROUNDWATER FLOW PROBLEMS BY MEANS OF PASSIVE ELECTRICAL ANALOGUE MODELS BY DISCRETIZATION OF THE TIME VARIABLE,
Technische Universitaet, Dresden (East Germany).
Ludwig Luckner, and Dietmar Peukert.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 423-432, 1969. 10 p, 4 fig, 5 ref.

Descriptors: *Groundwater movement, *Flow, *Analog models, Mathematical studies, Equations, Aquifer characteristics, Storage capacity, Transmissivity, Flow characteristics.

For nonstationary vertical plane and axial rotational symmetric groundwater flow fields having a free surface, the fundamentals of simulation are found on electrically conducting paper, in the electrolytic tank, and in R-networks drainage wells for the drainage of open-work minings. The dependence of the profile transmissibility on the potential in the horizontal plane flow can be simulated by means of R-networks if the time variable is discretional. The profile transmissibility to be simulated can be maintained constant when adopting correction currents. Based on these possibilities the fundamentals of two methods are described where the entire nonlinearity is concentrated in the potentials applied at the time resistors. These methods represent a good base for hybrid calculations. (Woodard-USGS)
W71-02261

TRANSIENT CHARACTERISTICS OF SALT-WATER WEDGE,
Saitama Univ., Urawa (Japan). Dept. of Foundation Engineering.
Sukeyuki Shima.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 433-440, 1969. 8 p, 5 fig, 4 ref.

Descriptors: *Groundwater movement, *Saline water, *Flow characteristics, *Aquifers, Beaches, Mathematical studies, Equations, Theoretical analysis, *Saline water intrusion, Saline water-freshwater interfaces.
Identifiers: *Salt-water wedge, Coastal aquifers.

Transitional characteristics of salt-water wedges in unconfined aquifers are investigated with special consideration to the effects of changes in freshwater depth at coastal line, and deformations of the shape of moving interfaces. Theoretical treatments concerning wedge intrusion, when a barrier is abruptly removed, are made. The results are compared to the experimental data, and a fair agreement between theory and experiment are obtained. (Woodard-USGS)
W71-02262

VELOCITY AND SURFACE SLOPE RELATIONSHIPS IN UNSTEADY LAMINAR FLOW,
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-02263

MATHEMATICAL MODELS OF GROUNDWATER FLOW,
Technische Universitaet, Dresden (East Germany).
Karl-Franz Busch, and Ludwig Luckner.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 401-409, 1969. 9 p, 1 tab. 1 ref.

Descriptors: *Groundwater movement, *Mathematical models, Fluid mechanics, Hydraulic conductivity, Theoretical analysis, Saturated flow, Unsaturated flow, Aquifer characteristics, Soil profiles, Flow, Diffusion, Boundaries (Surface), Velocity, Equations, Density, Gravity, Kinetics.

The mathematical model for all kinetic processes of the law consists of conservation of energy, the law of conservation of matter, validity laws and equations of boundary conditions. The kinetic laws can be derived theoretically as force equilibrium laws (special forms of the law of the conservation of energy) for the saturated and unsaturated filter flow. Thus these previously empiric laws turn to theoretically based fundamental laws so that clear statements can be made as to their limitations of validity. The laws of conservation of mass serve as special forms of the law of conservation of matter for mathematical models of groundwater movement where the following laws can be derived: one law in the interior of the field, one law at the free surface which can be considered as the boundary condition, and one law comprehending all the flow and storage processes. The most important mathematical models of groundwater flow are summarized in a table. (Woodard-USGS)
W71-02264

CONTROL OF SEA WATER LEVEL IN COASTAL POROUS MEDIA BY MEANS OF DOUBLE PUMPING,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-02265

THE STUDY OF COLLECTOR WELLS BY MEANS OF VISCOUS FLOW ANALOGY,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 08B.
W71-02266

NON-DARCY FLOW SOLVED BY FINITE ELEMENT ANALYSIS,
Windsor Univ., Ontario. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-02267

THE INTEGRAL DISPLACEMENT OF THE FLUIDS THROUGH NONHOMOGENEOUS POROUS MEDIA,
Academia R.P.R., Bucharest.
For primary bibliographic entry see Field 08B.
W71-02268

WATER MOTION IN EARTH STRUCTURES AT VARYING WATER LEVELS IN A REACH,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-02269

DEEP WELL DISPOSAL STUDY FOR BALDWIN, ESCAMBIA AND MOBILE COUNTIES, ALABAMA,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 05E.
W71-02428

HYDRAULIC TESTS IN HOLE UA-1 AND WATER INFLOW INTO AN UNDERGROUND CHAMBER, AMCHITKA ISLAND, ALASKA,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04B.
W71-02429

NUMERICAL SOLUTIONS FOR THE RADICAL SUBSURFACE FLOW PROBLEM,
National Center for Atmospheric Research, Boulder, Colo. Atmospheric Science Lab.
For primary bibliographic entry see Field 02G.
W71-02444

THE ROCK AND BONG TECHNIQUES OF MEASURING WATER LEVELS IN WELLS,
Missouri Univ., Rolla. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 07B.
W71-02445

SOME LIMITATIONS OF SEISMIC REFRACTION METHODS IN GEOHYDROLOGICAL SURVEYS OF DEEP ALLUVIAL BASINS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. E. Wallace.
Groundwater, Vol 8, No 6, p 8-13, November-December 1970. 6 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Hydrogeology, *Seismic studies, *Water table, *Arizona, Alluvium, Exploration, Geology, Mapping, Geophysics, Water levels, Geology, Aquifers, Permeability, Transmissivity, Groundwater movement.
Identifiers: *Groundwater prospecting, Tombstone (Ariz), Walnut Gulch Experimental Watershed, Experimental watersheds.

Seismic methods combined with available well and geologic data were used to define the subsurface hydrologic and geologic conditions of the Walnut Gulch Experimental Watershed, a deep, alluvial basin near Tombstone, Arizona. Seismic determinations revealed depths to the water table ranging from near zero to 475 feet in the central portion of the watershed. The accuracy of predicting the depth to either groundwater or basement was 6 percent, while that for groundwater alone was 10 percent. The great depths of alluvium created the problem of estimating the seismic traverse length necessary to accurately determine the alluvium-basement interface. Increased compaction of alluvium with depth causes additional interpretation difficulties in some areas. Also, water-table eleva-

tion may not always be accurately determined above and close to a higher velocity layer. Gravity or well log information greatly increases the reliability of seismic information. (Knapp-USGS)
W71-02446

GROUNDWATER AVAILABILITY IN FORD COUNTY,
Illinois State Water Survey, Urbana.
James P. Gibb.
Illinois State Water Survey Circular 97, 1970. 66 p, 13 fig, 2 tab, 24 ref, 2 append.

Descriptors: *Groundwater, *Water resources, *Illinois, Geology, Aquifers, Wells, Geologic mapping, Groundwater movement, Water table, Water supply, Water quality, Chemical analysis, Data collections, Aquifer characteristics, Water yield, Specific capacity, Consumptive use.
Identifiers: *Ford County (Ill).

Groundwater in Ford County, Illinois normally can be obtained from one of two primary water-bearing units within the glacial drift or from the underlying bedrock formations. The drift deposits consist of the Wisconsinan, Illinoian, and Kansan age glacial materials underlain by Pennsylvanian, Mississippian, Devonian, and Silurian age bedrock formations. Glacial deposits of Wisconsinan age provide approximately 64 percent of the county's current water supply. An estimated 2.2 million gallons of water are pumped from the aquifers of Ford County each day to satisfy industrial, municipal, domestic, and rural needs. A much larger quantity of water, perhaps as much as 51 million gallons a day, could probably be withdrawn without overdevelopment. Maps and tables indicating the probable maximum depth of wells, water levels, chemical quality, and general groundwater conditions for each water-bearing unit at specific locations are presented to serve as a guide in the development and utilization of the groundwater resources of Ford County. (Woodard-USGS)
W71-02449

GEOLOGY AND GROUNDWATER RESOURCES OF LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
Robert E. Hansen.
Iowa Geological Survey Water Supply Bulletin No 10, 1970. 66 p, 25 fig, 6 plate, 8 tab, 33 ref.

Descriptors: *Groundwater, *Water resources, *Geology, *Iowa, Aquifers, *Aquifer characteristics, Water yield, Water quality, Chemical analysis, Water supply, Consumptive use, Data collections, Water levels, Water sources, Hydrologic data.
Identifiers: *Linn County (Iowa).

Linn County, in east-central Iowa, covers about 713 square miles and lies in the Western Young Drift section of the Central Lowlands physiographic province. The normal annual rainfall in the county is about 33 inches and the annual mean temperature is about 48 degrees F. The population in 1960 was 136,899, of which 75 percent was urban. Groundwater sources involving the identification and delineation of the water-bearing rock units and an evaluation of the availability, yield, and chemical quality of water contained in these rocks are presented. This information will supply the data necessary to determine alternate sources of groundwater in problem areas and to define the most favorable groundwater sources for future needs. The principal aquifers are alluvium, buried channel deposits, Silurian-Devonian limestones and dolomites, and the Jordan Sandstone. All yield fair-to-good quality water, although the water is hard and locally contains high concentrations of iron. All are capable of yielding as much as 500 gallons or more per minute to wells. (Woodard-USGS)
W71-02450

DIGITAL SIMULATION OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, KANSAS,
Kansas State Geological Survey, Colby.
Thomas J. McClain.
Geological Survey Open-file Report, 1970. 30 p, 10 fig, 3 tab, 11 ref.

Descriptors: *Groundwater, *Water resources, *Kansas, *Computer models, Computer programs, Water supply, Consumptive use, Observation wells, Data collections, Hydrologic data, Water table, Aquifer characteristics, Water yield, Future planning (Projected), Digital computers, Equations, Water levels.
Identifiers: *Ogallala aquifer, *Sherman County (Kan).

An area of 340 square miles was selected for developing a digital computer model of the Ogallala aquifer. The digital model was adapted to simulate inflow, outflow, water levels, recharge, transmissivities, storage coefficients, saturated thickness, and discharge. The model was tested and found to be compatible with actual field conditions during the period 1966 through 1969. It was then programmed to define the effects on water levels of future development (1970 through 1989). With the continued groundwater development and annual pumpage assumed, digital model computations indicate a depletion of the aquifer in the area studies by 19 percent by 1981 and 40 percent by 1990. With no increase in development or annual pumpage from 1970 through 1989, model computations indicate that the aquifer could be depleted by 26 percent. A storage coefficient of 0.15 was used in this study but computations indicate that a slightly larger storage coefficient of 0.16 or 0.17 could have been used. (Woodard-USGS)
W71-02454

WATER-RESOURCES INVENTORY SPRING 1968 TO SPRING 1969--ANTELOPE VALLEY-EAST KERN WATER AGENCY AREA, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02E.
W71-02455

EVALUATION OF RESOURCES OF SHALLOW AQUIFIERS (IN FRENCH),
For primary bibliographic entry see Field 02A.
W71-02467

GROUNDWATER IN MONTANA,
Montana Bureau of Mines and Geology, Butte.
Miller Hansen.
Montana Water Resource Board Inventory Series Report No 16, November 1969. 145 p, 59 fig, 3 tab, 6 ref.

Descriptors: *Groundwater, *Water resources, *Montana, Aquifers, Water yield, Storage, Recharge, Water quality, Geology, Aquifer characteristics, Wells, Precipitation (Atmospheric), Water table, Pumping, Hydrologic data, Springs, Water levels, Domestic water, Irrigation, Specific capacity, River basins, Maps.

Published groundwater reports and other reports containing information required in estimating availability of groundwater in Montana, were reviewed, summarized, and compiled into one publication. The unconsolidated aquifer summaries provide information that includes aquifer area, thickness, specific yield, groundwater in storage, perennial recharge, and water quality in each report area. The unconsolidated aquifers are grouped by drainage basins in this compilation. More than 42,000 wells and 18,000 springs in both the unconsolidated and in the bedrock aquifers are recorded under the provisions of Montana water laws. Springs are of considerable importance in Montana for domestic, stock, municipal, and irrigation water. An important use of springs is shown by the location of fish hatcheries at several springs in the State. The quality of groundwater is generally excellent to good in western Montana, excellent to fair in central Montana, and good to poor in the eastern part of the state. (Woodard-USGS)
W71-02468

BIBLIOGRAPHY OF MONTANA WATER RESOURCES AND RELATED PUBLICATIONS.
Montana Water Resources Board, Helena.
For primary bibliographic entry see Field 10.
W71-02469

PRELIMINARY INVENTORY OF THE WATER RESOURCES OF IDAHO.
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 07C.
W71-02471

AVERAGE ENTITIES IN KINEMATICS AND THERMODYNAMICS OF POROUS MATERIALS,
Technion - Israel Inst. of Tech., Haifa. Lab. of Soil Science.
Dan Zaslavsky.
Soil Science, Vol 106, No 5, p 358-362, November 1968. 1 fig, 34 equations, 3 ref. P.L. 480.

Descriptors: *Porous media, *Thermodynamics, *Soil physics, *Groundwater movement, *Arid lands, Equations, Mathematical studies, Properties.
Identifiers: *Kinematics, *Continuum mechanics, *Media phases, *Soil-water relationships, Parameters, Fluxes.

Mathematical treatment of porous medium properties allows better utilization of ground-water--the primary water source for arid and semi-arid lands. A porous medium has these characteristics: (a) it consists of many different kinds of phases (homogeneous, heterogeneous, porous), some being fluid, partially fluid, or solid; (b) its different phases are spacially well distributed and (c) it can be treated as a continuum. The source of its heterogeneity may be in particles or portions of different size orders, ranging from molecules to geographic regions. The use of derivatives and integrals in the formulation of general laws for porous media requires the definition of properties which vary as a continuum. This approach has been implicit. This article develops the formulation of general laws systematically and explicitly. Definition of a continuum, averaging the parameters of contents, averaging the fluxes, the two-translated subsystem, average rotation, and the general form of average forces are discussed through 34 equations, in vector, integral, total and partial derivative form. Thermodynamic forces are also considered. (Popkin-Arizona)
W71-02518

LOCATING AND TRACING SEEPAGE WATER IN UNSTABLE SLOPES,
Kentucky Dept. of Highways, Lexington. Div. of Research.
For primary bibliographic entry see Field 04A.
W71-02522

2G. Water in Soils

ROOT EXPLORATION RATE: A NEW CONCEPT IN THE STUDY OF SOIL WATER REMOVAL BY PLANTS (IN FRENCH),
Oregon State Univ., Corvallis. Dept. of Soils.
L. W. De Backer, and L. Boersma.
In: Science du Sol - No 2, Supplement au Bulletin de l'Association Francaise pour l'Edude du Sol, p 3-20, 1968. 18 p, 8 fig, 6 tab, 4 ref. OWRR Project B-001-ORE (4).

Descriptors: *Moisture uptake, *Root zone, Moisture availability, Soil moisture, Soil moisture movement, Transpiration, Water utilization, Oak trees, Fir trees.
Identifiers: Root exploration rate (Plants).

From a plot of cumulative soil water uptakes by plants with depth over a period of time, a curve of the slopes of this cumulative function versus depth is obtained. Such a curve presents a maximum interpreted as being the depth of greatest root activity. From a series of such curves, it is possible to plot the advance of the maximum root activity zone during the soil water depletion cycle. The time rate of change of the maximum root activity depth defines the root exploration rate. Under the same climatic conditions, the root exploration rate of oaks was five times greater than that of douglas firs, whereas the soil water availability of the fir plot was about 2.5 times greater than that of the oak plot. Combining the water availability coefficient and the porosity of the soil with the root exploration rate, it is possible to establish the rate of water used by the plants. (Knapp-USGS)
W71-02203

MUD VOLCANO CLAY, TRINIDAD, WEST INDIES,
Columbia Univ., New York. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W71-02213

HYDRODYNAMICS OF FLOW IN POROUS MEDIA,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 04A.
W71-02260

WATER MOTION IN EARTH STRUCTURES AT VARYING WATER LEVELS IN A REACH,
Akademiya Nauk SSSR, Novosibirsk.
V. G. Pryazhinskaya.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 257-263, 1969. 7 p, 5 fig, 3 ref.

Descriptors: *Unsteady flow, *Water level fluctuations, *Bank storage, *Groundwater movement, *Surface-groundwater relationships, Filtration, Recharge, Water storage, Discharge (Water), Computer programs, Mapping, Mathematical studies.
Identifiers: *Unstable filtration.

Problems of unstable filtration of groundwater may be solved by conformal mapping, using numerical calculations on electronic computers. The problem of unstable filtration caused by water surface fluctuations in the adjoining reservoir, and the physical analogies of groundwater motion due to waves on infiltration near the gently sloping sea coast are examples presented. The potential nonstationary motion of groundwaters with a free surface occurs in the homogeneous material of infinite depth. (Knapp-USGS)
W71-02269

FILTRATION CALCULATIONS OF HORIZONTAL AND VERTICAL DRAINAGES IN NON-UNIFORM STRATIFIED SOILS,
Akademiya Nauk URSR, Kiev.
A. Y. Oleinick.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 239-246, 1969. 8 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Drainage systems, *Soil water movement, Water levels, Mathematical studies, Water wells, Aquifers.
Identifiers: Non-uniform stratified soils.

Methods are given for calculation of flow to horizontal drains and incomplete vertical wells in two-layer and three-layer strata. These methods are the result of the strict solution of water inflow to horizontal drains and vertical wells in stratified soils. On the basis of these solutions practical methods have been worked out to be used for calculating water lowering, the capture of fresh and salt waters, or draining hydrotechnical structures. A formula for determining drain discharge per unit length and the yield of an incomplete well is also presented. (Knapp-USGS)
W71-02270

ANALYTICAL TREATMENT OF TWO-PHASE INFILTRATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Richard L. Brustkern, and Hubert J. Morel-Seytoux.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7743, p 2535-2548, December 1970. 14 p, 10 fig, 8 ref, append.

Descriptors: *Unsaturated flow, *Computer programs, *Numerical analysis, *Infiltration, Soil moisture movement, Porous media, Capillary action.
Identifiers: *Multiphase flow.

An approximate analytical treatment for the problem of one-dimensional infiltration into a homogeneous porous medium is presented. Movement of both the air phase and the water phase is considered. The procedure assumes that capillary pressure can be neglected in the saturation equation, whereas it is retained in an integral equation for the unknown total flow. The two equations are solved in a step-wise manner to yield the saturation profile, and the infiltration rate at any time. Infiltration rate curves are obtained for a number of situations involving different boundary or initial conditions or both. Infiltration rate predictions are in good agreement with those predicted by a finite difference solution. This is quite promising in view of the fact that the computer costs are an order of magnitude less than by the finite difference technique. (Knapp-USGS)
W71-02430

HYDROLOGY OF SPRAY-RUNOFF WASTE WATER TREATMENT,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W71-02437

SOIL CATENA CONCEPT FOR HYDROLOGIC INTERPRETATIONS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
S. L. Chiang, and G. W. Petersen.
Journal of Soil and Water Conservation, Vol 25, No 6, p 225-227, November-December 1970. 3 p, 3 tab, 8 ref.

Descriptors: *Rainfall-runoff relationships, *Soil water movement, *Infiltration, *Soil physical properties, *Soil classifications, Soil groups, Soil investigations, Soil types, Hydrogeology, Surface-groundwater relationships.
Identifiers: Soil catenas, *Runoff-soil water relationships.

Understanding the relationship between soil characteristics and the behavior of runoff water is requisite to improved soil and water conservation. To effectively convey hydrologic soils information from soil scientists to non-soil scientists, an ideal soil catena diagram is proposed. This diagram relates parent material, texture, drainage, depth, and to some extent, the subsurface conditions of the soil. Soils of low runoff potential have high infiltration rates even when thoroughly wetted and consists chiefly of deep, well to excessively drained sands or gravels. Soils having moderate infiltration rates when thoroughly wetted are chiefly moderately deep to deep, moderately well to well-drained, with moderately fine to moderately coarse textures. Soils having slow infiltration rates when thoroughly wetted usually have a layer that impedes downward movement of water, or have moderately fine to fine texture. Soils of high runoff potential have very slow infiltration rates when thoroughly wetted and include clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. (Knapp-USGS)
W71-02442

NUMERICAL SOLUTIONS FOR THE RADICAL SUBSURFACE FLOW PROBLEM,
National Center for Atmospheric Research, Boulder, Colo. Atmospheric Science Lab.
Ronald L. Drake, and Michael B. Ellingson.
Groundwater, Vol 8, No 6, p 39-47, November-December 1970. 9 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Soil water movement, *Numerical analysis, *Unsteady flow, *Unsaturated flow, *Diffusivity, Mathematical studies, Percolation, Subsurface flow.
Identifiers: *Radial subsurface flow.

Two stable finite difference schemes are presented for the numerical solution of the nonlinear partial differential equation describing the radial flow of soil moisture. The nonlinearity exists because soil moisture diffusivity is a nonconstant function of the nondimensional soil moisture. Numerical solutions are given for 21 different moisture-dependent diffusivities. From these numerical solutions quantitative results are obtained for the following: (1) the boundedness and monotonicity of the moisture distribution; (2) the continuous dependence of the moisture distribution on the system's parameter, namely, the diffusivity; (3) the rate at which the wetting front approaches the steady state solution; (4) the evolution of the moisture front with time and with the formulation of the diffusivity; and (5) the time evolution of the rate of inflow or outflow at the wall of the source or sink. (Knapp-USGS)
W71-02444

BROWN STEPPE SOIL IN THE UPPER PART OF WADI EATEL (NORTHWEST TRIPOLITANIA),
Institute for Soil Research, Belgrade (Yugoslavia).
D. J. Filipovic, and M. Spasojevic.
Soil Science, Vol 106, No 2, p 131-135, August 1968. 4 tab, 4 ref.

Descriptors: *Soil surveys, *Soil physical properties, *Sierozems, *Agriculture, *Brown soils, Irrigation, Porous media, Soil chemical properties, Hydraulic conductivity, Loam, Porosity, Water quality, Arid lands, Cation exchange, Sands, Soil texture, Particle size, Darcys law, Soil density, Field capacity, Wilting point.
Identifiers: *Brown steppe soil, *Wadi Eatel (Northwest Tripolitania), *Libya, *Irrigation potential, Darcys coefficient, Bulk density, Cation exchange capacity.

About 8000 ha. of the Wadi Eatel in Northwest Tripolitania (Libya) is covered by brown steppe soil. The soil is sandy loam and loamy sand, formed on calcareous material consisting of three subvarieties. Sandy loam samples had respectively: porosity, Darcy coefficient, cation exchange capacity, and bulk density ranges of 47.80 to 52.00 volume percent, .00010 to .00045 K cm/sec, 8.76 to 13.83 meq/100g, and 1.39 to 1.43 g/ccm. Loamy sand samples showed porosity, Darcy coefficient, cation exchange capacity, and bulk density ranges of 44.00 to 48.10 volume percent, .00046 to .00640 K cm/sec, 7.35 to 14.00 meq/100g, and 1.37 to 1.46 g/ccm. A water sample taken in the upper part of the wadi showed high salinity (dissolved solids — 1302 ppm), and was suitable for supplemental winter irrigation on brown steppe soils. Chemical soil properties are favorable for agriculture. Mineral fertilizers would make more intensive soil utilization possible. Irrigation could become very useful where it can be provided. Tables present soild texture, chemical and physical properties, and water analyses. (Popkin-Arizona)
W71-02502

SOIL GEOGRAPHY AND FACTORS OF SOIL FORMATION IN AFGHANISTAN,
Wisconsin Univ., Madison. Dept. of Soil Science.
M. Zarif Salem, and Francis D. Hole.
Soil Science, Vol 107, No 4, p 289-295, April 1969. 6 fig, 17 ref.

Descriptors: *Soil formation, *Plant groupings, *Soil-water-plant relationships, *Soil profiles, *Arid lands, Sierozems, Grasslands, Climatic zones, Alluvium, Loam, Sands, Dunes, Deserts, Clays, Geographic regions, On-site observations, Precipitation (Atmospheric), Drainage patterns (Geologic).
Identifiers: *Soil geography, *Pedogenesis, *Phytogeographical provinces, *Afghanistan, Alluvial soil, Humic Gley soil, Low-latitude desert, Asiatic climatic system.

This study reports on field observations of 8 Afghanistan soil profiles, general information on soil geography and pedogenetic factors. Two are alluvial soils (Darweshan silty clay, or Typic Ustifluvent, and Shisham Bagh sandy loam, or Typic Ustifluvent), five are Desert soils (Kabul silt loam, or Mollic Haplargid, Nadi Ali sandy loam, or Typic Haplargid, Bost sandy loam, or Typic Haplargid, Alchin silt loam, or Typic Haplargid, and Abul Khail silt loam, or Typic Haplargid), and one a Humic Gley (Pozay Aishan silty clay, or Cumulic Argiaquoll). About 40 percent of the country is in arid wastelands. The topography consists of lowlands (sand dunes, salty marshes, playas), plains (sand dunes, desert flats, playas, broad river valleys), plateaus and uplands (marshlands and small lakes), and mountain ranges, high mountain ranges and peaks (mountain glaciers). Afghanistan is located in the low-latitude desert and steppe belt of the Asiatic climatic system. Six phytogeographical provinces are correlated with 8 climatic zones, where temperature, dryness index (evaporation/precipitation ratio), precipitation and wind are important. Maps of topography, soil, drainage, climatic types, and phytogeography and representative soil profile section are included. (Popkin-Arizona)
W71-02503

GILGAI IN THE QUATERNARY,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
E. G. Hallsworth, and G. G. Beckmann.
Soil Science, Vol 107, No 6, p 409-420, June 1969. 1 tab, 2 fig, 36 ref.

Descriptors: *Soil physical properties, *Soil physics, *Quaternary period, *Hydraulic conductivity, *Arid lands, Wetting, Particle size, Plasticity, Paleohydrology, Paleoclimatology, Soil profiles, Soil groups, Geomorphology, Cracking, Geologic formations, Montmorillonite, Drying, Data collections.
Identifiers: *Soil micromorphology, *Gilgai phenomena, *Gilgai classification, *Australia, *Swelling profile, Layering, Paleogeography.

An account is given of data on soil, showing the gilgai phenomena and presenting analyses of factors responsible for the different forms. Attention is given to possible relationships between gilgai and Quaternary history. Gilgai is applied to describe the surface micromorphological phenomena of alternate hummocks and hollows of soils beyond periglacial areas. The phenomena is widespread in Australia. Gilgai forms are classified as normal (round), melon-hole, lattice, linear (wavy), tank, and stony. The surface soil material of the mounds is related to and continuous with the subsoil of the depressions. Gilgai soils are predominantly montmorillonitic. Micromorphology suggests that gilgai soils are sedimentary in origin and show layering. Magnitude and pattern of the gilgai, formed by soil cracks on drying and wetting, are results of swelling profile, size of soil aggregates, wetting cycle, hydraulic conductivity profile and plasticity profile. The gilgai are a clue to paleoclimate, paleohydrology and paleogeography. Analytical data for gilgai in Australia, South Dakota and Katanga are tabulated. Figures of gilgai types and a cross section of a depression are included. (Popkin-Arizona)
W71-02505

EFFECT OF TEMPERATURE AND pH ON SODIUM TRANSLOCATION AND SODIUM EXCHANGE REACTIONS IN BUSH BEANS,
California Univ., Los Angeles.
Arthur Wallace.
Soil Science, Vol 106, No 2, p 144-148, August 1968. 9 tab, 12 ref. NSF Grant No 3683.

Descriptors: *Temperature, *Acidity, *Translocation, *Sodium, *Soil-water-plant relationships, Ammonium salts, Carbon dioxide, Root systems, Beans, Hydrogen ion concentration, Plant physiology, Aeration, Salts, Damages, Cation exchange.
Identifiers: *Bush beans, *Sodium exchange reactions, Milk acid, Plant injury.

Bush beans (Phaselus vulgaris var. Improved Tendergreen) were studied for sodium translocation effects to determine information concerning poor translocation of sodium to shoots. Temperatures up to 70 degrees C for short time periods greatly increased sodium translocation without killing the plants, but new roots were generated. Growing plants in nutrient solutions at 43 degrees C for 14 days injured plants and resulted in increased sodium translocation. Ammonium sulfate solutions at 10 to the minus 3 M resulted in enough acidity to increase sodium translocation to stems. The ammonium ion and CO sub 2 aeration caused sodium exchange or leakage. Milk acid treatments did not severely injure bean plants, but resulted in sodium translocation. Root sodium was not subject to exchange with potassium or calcium but was exchanged in 24 hours by external solution sodium indicating that translocation failure is not due to the sodium being chemically bound. Tables show temperature, ammonium sulfate, treatment, CO sub 2 aeration, acid and base treatment, and salt treatment effects. (Popkin-Arizona)
W71-02506

PROBLEMS OF DETERMINATION OF SOIL DENSITY AND MOISTURE PROPERTIES FROM NATURAL CLODS,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
D. S. McIntyre, and J. Loveday.
Soil Science, Vol 105, No 4, p 232-236, April 1968. 1 tab, 4 fig, 12 ref.

Descriptors: *Soil moisture, *Soil density, *Moisture content, *Soil pressure, *Wetting, Loam, Clays, Sampling.
Identifiers: *Natural clods, *Soil suction, *Bulk density.

This paper compares soil density and moisture measurements made on small clods equilibrated at a known suction with those determined from cores taken 24 to 30 hours after wetting. Specimens were taken on a range of soils, from loamy sands to cracking clays. Bulk density and moisture properties depended on the rate of wetting of the air-dry clods. Rapid wetting decreases the bulk density of clayey soils and increases the moisture retained throughout the suction range 50 to 600 cm. Recommended sampling includes use of large samples and sampling under moist conditions. Large volume clods are preferred if clods must be sampled. Wetting of clods should be carried out slowly beginning at suctions greater than 30 cm water. Figures are presented of the difference between 100 cm moisture percentages of clods at various wetting rates, bulk density versus wetting rates, core bulk density and moisture versus wetting rate, and extended time of measurement after wetting. (Popkin-Arizona)
W71-02507

DETERMINING WATER CONTENT OF DIFFERENT SOILS BY THE NEUTRON METHOD,
Agricultural Research Service, Riverside, Calif. Soil and Water Conservation Research Div.
R. E. Luebs, M. J. Brown, and A. E. Laag.
Soil Science, Vol 106, No 3, p 207-212, September 1968. 2 tab, 4 fig, 8 ref.

Descriptors: *Soil moisture meters, *Soil moisture, *Bulk density, *Instrumentation, *Calibrations, Soil physics, Moisture content, Nuclear meters, Depth, Volumetric analysis, Measurement, Soil types.
Identifiers: *Neutron method, *Neutron count rate, *Soil-water relationships.

Advantages which account for wide acceptance of the neutron method for determining soil water content include greater precision, rapidity of measurements, large volume measured and full range of soil water. Count rate and soil water content below the 30-cm depth differed for several soils. Observed maximum difference was equivalent to 4.4 per cent water by volume; curve slopes were similar for investigated soils. Higher count rates were associated with higher bulk density. The most accurate determinations by the neutron method require calibration of bulk density changes. A high linear correlation between count rate and soil water content was obtained for the 0- to 15- cm layer. Repeated determinations of soil water content in the undisturbed 0- to 15-cm layer can be obtained by calibrating for the particular soil and controlling depth of measurement. Tables show percentage of count rate variation with soil water content and count rate determined from calculated regression on volumetric water content. Figures show neutron calibration curves for two depth ranges, and effect of bulk density on counting rate and soil water content. (Popkin-Arizona)
W71-02515

INFLUENCE OF SOIL TEMPERATURE, IRRIGATION AND AERATION ON HEMICYCLIOPHORA ARENARIA,
California Univ., Riverside.
For primary bibliographic entry see Field 02I.
W71-02517

AVERAGE ENTITIES IN KINEMATICS AND THERMODYNAMICS OF POROUS MATERIALS,
Technion - Israel Inst. of Tech., Haifa. Lab. of Soil Science.
For primary bibliographic entry see Field 02F.
W71-02518

A STUDY OF THE HAMRA SOIL ASSOCIATION OF ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
D. Karmeli, and I. Ravina.
Soil Science, Vol 105, No 4, p 209-215, April 1968. 1 tab, 5 fig, 6 ref.

Descriptors: *Soil chemistry, *Soil physics, *Aeolian soils, *Sands, *Clays, Dunes, Cation exchange, Soil properties, X-ray analysis, Soil mechanics, Potassium, Loam, Fine-textured soils, Expansive soils, Electrophoresis.
Identifiers: *Israel, *Hamra soil association, *Cation-exchange capacity (CEC), *Soil-water relationships, Fractions, Electrophoretic mobility.

Hamra soils of Israel were found to consist of two main fractions: sand and clay. The clay--of eolian origin--is added to dune sands to form various soil types. Clay fraction properties are identical, irrespective of content and location. Cation exchange capacity (CEC), internal surface area, free swell properties, electrophoretic mobility, X-ray diffraction analyses, total potassium, chemical and mechanical analyses, and composition of the exchangeable cation complex are discussed. The table of results relates sand, sandy loam, sandy clay loam, sandy Nazaz, grey Nazaz, and black Nazaz to

14 chemical and physical properties. Figures of CEC as a fraction of fine content, frequency distribution of electrophoretic mobilities, X-ray diffractograms, and mechanical analyses are presented. (Popkin-Arizona)
W71-02519

SOIL FERTILITY UNDER CONTINUOUS CULTIVATION IN NORTHERN NIGERIA. I. THE ROLE OF ORGANIC MANURES,
For primary bibliographic entry see Field 05C.
W71-02690

2H. Lakes

BOTTOM STABILITY AND SEDIMENTARY PROCESSES AT LITTLE LAKE HARBOR, LAKE SUPERIOR,
United States Lake Survey, Detroit, Mich.
James H. Saylor, and Sam B. Upchurch.
Available from NTIS as AD-712 300, $3.00 in paper copy, $0.95 in microfiche. Research Report No 2-1, August 1970. 60 p, 38 fig, 1 tab, 21 ref.
Identifiers: *Sedimentation, Dissemination, *Harbors, Construction, *Marine engineering, Great Lakes, Mass transfer, Stability, Breakwaters, Sand, Gravel, Maintenance, Shallow water, Lake Superior, Littoral drift, *Harbor bottom stability, *Lacustrine environment, Shore protection.

The report discusses the relationship of littoral drift to sediment texture and fluctuations in offshore and strandline topography at Little Lake in southeastern Lake Superior. Offshore bars and troughs oscillate about a mean position, depending on the direction and intensity of wave attack. In contrast to the offshore bars and troughs, shallow-water topographic features migrate normal to and along shore with changes in lake level and wave attack. Sediment consists of two distinct populations: pebble-cobble and sand. The pebble-cobble population is relatively immobile and serves as an armor for the beach and nearshore. The sand population is highly mobile and its distribution reveals the effect of the harbor breakwaters on littoral drift. Littoral drift causes harbor maintenance problems, including shoaling in the harbor mouth and beach deterioration adjacent to the breakwaters. A primary cause of the shoaling is entrapment of a portion of the sand fraction bypassing the harbor structures by circulation patterns induced by harbor design.
W71-02293

A HYDROLOGICAL APPROACH TO CONTROL ACID MINE POLLUTION FOR LAKE HOPE,
Ohio Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 05G.
W71-02427

LAKE STRATIFICATION CAUSED BY RUNOFF FROM STREET DEICING,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 05B.
W71-02441

GENERAL SCHEME FOR CALCULATING THE WATER BALANCE OF CLOSED INLAND SEAS AND LAKES BY THE METHOD OF STATISTICAL MODELLING,
Georgian Power Research Inst., Tiflis (USSR).
G. G. Svanidze, and I. B. Khomeriki.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 289-294, July 1970. 6 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Water balance, *Statistical models, *Lakes, Equations, Reviews, Hydrologic cycle, Synoptic analysis, Hydrologic budget, Meteorology, Precipitation (Atmospheric), Runoff, Evaporation, Water storage, International Hydrological Decade.
Identifiers: *USSR, *Closed inland seas.

In arid regions, where evaporation from the water surface exceeds rainfall, there are, in closed basins, bodies of water without outflow. To such bodies of water in the USSR belong the Caspian and Aral seas, the Balkhash and Issyk-Kul lakes and a number of lesser lakes. The variability of water balance of such water bodies entails variations of water level which affect various branches of the economy (navigation, fishing, mining, agricultural utilization of coastal lands, resort economy, etc). In this report pertinent literature is reviewed from which a method is applied to a statistical model for water balance computations on a digital computer. (Woodard-USGS)
W71-02461

STORAGE IN THE WATER BALANCE OF THE LAKE ONTARIO BASIN,
Department of Energy, Mines and Resources, Cornwall (Ontario). Inland Waters Branch.
D. F. Witherspoon.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 283-288, July 1970. 6 p, 2 fig, 4 ref.

Descriptors: *Water balance, *Water storage, *Lake Ontario, *Basins, Hydrologic cycle, Model studies, Equations, Meteorology, Synoptic analysis, Precipitation (Atmospheric), Evaporation, Runoff, Streamflow, Solar radiation, Soil moisture, Soil water movement, Water storage, Groundwater, Surface waters, Vegetation, International Hydrological Decade.

Using a hydrologic model based on the water balance, the annual run of storage and its extremes are studied to determine the significance of this factor in the balance of a large land basin of 27,100 square miles which contributes to the local inflow of Lake Ontario. Estimates obtained are reasonable when compared with values estimated from the physical and hydrologic characteristics of the basin. These estimates demonstrate the relative importance of storage to the month by month hydrology of the basin. The storage on the basin is approximately equivalent in volume to that available within the range of stage of Lake Ontario allowable by international agreement between Canada and the United States. (Woodard-USGS)
W71-02462

PHOSPHATE EXCHANGE WITH SEDIMENTS: ITS ROLE IN THE PRODUCTIVITY OF SURFACE WATERS,
Harvard Univ., Cambridge, Mass.
W. Stumm, and J. O. Leckie.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 2, 1970. Preprint. 16 p, 11 fig, 36 ref.

Descriptors: *Phosphates, *Sediments, *Lakes, Primary productivity, Sediment-water interfaces, Oxygenation, Iron, Aluminum, Calcium, Dredging, Solubility, Kinetics.
Identifiers: Redox potential, Lake Constance, Lake Zurich, Lake Norrviken, Bering Sea.

The availability of phosphorus to algae present in surface waters is a composite function of the supply of total phosphorus in the water basin, release of phosphorus from sediments, regeneration from biota and detritus, and transport processes. The release of phosphates from sediments to epilimnion depends primarily on their diffusion through the interstitial water. For an undisturbed sediment-water interface a maximum phosphorus transfer of 0.000009 mole/ sq meter per day may be estimated. In many cases reactions with iron, aluminum, and calcium immobilize considerable quantities of phosphorus in insoluble form. Various solution parameters induce crystal growth of apatite, the process particularly enhanced in the presence of fluorite. The removal of sediments by dredging may release a large supply of nutrients into water, cause disturbance between benthos and plankton, and lower the buffer capacity of the lake and its resistance to external changes. (Wilde-Wisconsin)
W71-02520

PHOSPHORUS, NITROGEN, AND ALGAE IN LAKE WASHINGTON AFTER DIVERSION OF SEWAGE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-02681

2I. Water in Plants

ROOT EXPLORATION RATE: A NEW CONCEPT IN THE STUDY OF SOIL WATER REMOVAL BY PLANTS (IN FRENCH),
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 02G.
W71-02203

ANALYSIS OF THE DUAL ACTION OF WHITE LIGHT ON GERMINATION OF ATRIPLEX DIMORPHOSTEGIA (CHENOPODIACEAE),
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
D. Koller.
USDA Grant FG-Is-115. Israel Journal of Botany, Vol 19, No 2, p 499-516, 1970. 6 fig, 11 tab, 12 ref.

Descriptors: *Germination, *Irradiation, *Temperature, *Moisture stress, *Soil-water-plant relationships, Light, Metabolism, Plant growth substances, Mode of action, Physiological ecology, Environmental effects, Laboratory tests, Xerophytes, Photoactivation, Photoperiodism, Inhibition, Varieties, Energy transfer, Plant physiology, Seeds, Infrared radiation, Dispersion.
Identifiers: *Seedlings, *Phytochromes, *Temperature effects, Israel, Negev Desert.

Atriplex dimorphostegia is a Negev Desert plant with 'humped' and 'flat' seed dispersal unit varieties. A percentage of the seeds germinate in the dark at an optimal temperature of 10 deg C. The non-germinating fraction can be induced to germinate by short irradiation with white light. Continuous irradiation is not only ineffective but also inhibits the dark-germination fraction. With photoperiodic irradiation, increasing light/dark ratios resulted in decreasing germination percentages. Germination was promoted by light in the red and inhibited by the far red, indicating that irradiation effects are mediated by phytochromes. The promotive effect of short irradiation is prevented if preceded or followed by long irradiation. Seeds pretreated in darkness at supra-optimal temperature or subjected to water stress were strongly stimulated by short irradiation. Both treatments lessened the inhibitory effects of long irradiation. It is thought that high temperature not only causes promotive phytochrome formation but also interrupts some metabolic pathway resulting in partial inhibition of the phytochrome system. Since they produce synergistic effects on germination, water-stress probably acts to mask the metabolic interruption caused by supra-optimal temperatures. In all cases the 'humped' seeds were more susceptible to inhibitory treatments and less susceptible to promotive treatments. (Casey-Arizona)
W71-02500

SOIL GEOGRAPHY AND FACTORS OF SOIL FORMATION IN AFGHANISTAN,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W71-02503

THE CATIONS OF THE COTTON PLANT IN SODIUM SUBSTITUTED POTASSIUM DEFICIENCY,
Texas Agricultural Experiment Station, College Station.
J. V. Amin, and H. E. Joham.
Soil Science, Vol 105, No 4, p 248-254, April 1968. 4 tab, 10 ref.

Descriptors: *Cotton, *Potassium, *Sodium, *Cation exchange, *Soil-plant-water relationships, Solubility, Calcium, Leaves, Plant tissues, Root systems, Nutrient requirements, Proteins, Crop response.
Identifiers: *Potassium deficiency, *Sodium substitution, *Synergistic action, Stems.

Cotton plant cations were studied under conditions of adequate, partially-substituted (Na for K), and deficient potassium nutrition by dividing cations into alcohol soluble and insoluble fractions. The solubility order was: K greater than Na greater than Ca. Potassium deficiency increased the insoluble K/soluble K ratio of the leaves. Increased potassium mobility, increased K absorption and change in K phase distribution in the presence of Na are involved in Na substitution for K in cotton plant nutrition. Substrate Na addition increased Ca in both soluble and insoluble phases. In the range of K substitution, constancy of cations is maintained by synergistic action between Na and other plant cations, including K. Tables show total and percent soluble K, Na, Ca, and protein content as influenced by various K and Na treatments with time. (Popkin-Arizona)
W71-02504

EFFECT OF TEMPERATURE AND pH ON SODIUM TRANSLOCATION AND SODIUM EXCHANGE REACTIONS IN BUSH BEANS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 02G.
W71-02506

ATMOSPHERIC-AND SOIL-INDUCED WATER STRESSES IN PLANTS AND THEIR EFFECTS ON TRANSPIRATION AND PHOTOSYNTHESIS,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-02508

DROUGHT RESISTANCE OF CYPRESS AND THUYA BRANCHLETS,
Hebrew Univ., Jerusalem (Israel). Dept. of Plant Physiology.
H. R. Oppenheimer.
Israel Journal of Botany, Vol 19, No 2, p 418-428, 1970. 5 fig, 2 tab, 13 ref.

Descriptors: *Plant morphology, *Transpiration, *Xerophytes, *Coniferous trees, *Drought resistance, Stomata, Moisture stress, Leaves, Plant physiology, Plant groupings, Plant tissues, Vascular tissues, Mode of action, Environmental effects, Laboratory tests, Epidermis, Saturation, Water loss, Water conservation, Regulated flow, Physiological ecology, Drought tolerance, Dehydration, Moisture deficit.
Identifiers: *Cypress trees, *Leaf scales, *Water saturation deficits, *Ramilli, *Hydrophobic properties.

Isolated branchlets (ramilli) of 3 xerophytic Cupressaceae species, Cupressus sempervirens, C. glabra and Thuja orientalis, were investigated to determine their absolute and relative drought resistance capabilities. Leaf tissue morphology studies showed that all had imbricate scales, cutin layers overlaying the epidermis and infrequent stomata. Thuja had relatively less imbrication, spongier scale inner structure, thinner cutin, more Ca oxalate and more frequent stomata on unprotected leaf areas. Two aspects never before seen in the cypresses were stomatal concentrations in the protected grooves between the scales and presence of cutinous papillae. Transpiration, calculated as losses of initial weight/hr, was low and extremely variable in all 3 species. During desiccation, vital staining studies indicated inner tissue death in all species occurred only when water losses reached 50% of water content at saturation (WSD) while primary meristems, bundle elements and epidermis were even more resistant, demonstrating a high drought tolerance. Of the 3, Thuja proved the most drought tolerant, probably because of better stomatal regulation and a more efficient cuticle. Stomatal arrangements indicate a 'trickling' type of transpiration with positive and zero phases. The physiological behavior of these species appears to correlate well with their geographical and ecological distributions. (Casey-Arizona)
W71-02509

THE EFFECT OF WATER STRESS ON THE POLYSOME POPULATION AND THE ABILITY TO INCORPORATE AMINO ACIDS IN MAIZE ROOT TIPS,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
I. Nir, Alexandra Poljakoff-Mayber, and S. Klein.
Israel Journal of Botany, Vol 19, No 2, p 451-462, 1970. 2 fig, 5 tab, 19 ref.

Descriptors: *Corn (Field), *Biochemistry, *Amino acids, *Moisture stress, *Root systems, Electron microscopy, Sedimentation rates, Chemical properties, Mode of action, Plant physiology, Radiochemical analysis, Proteins, Laboratory tests, Soil-water-plant relationships, Metabolism, Chemical reactions, Synthesis, Separation techniques, Dehydration, Hydration, Physiocochemical properties, Plant tissues, Cytological studies, Genetics, Chromosomes, Damages, Absorption.
Identifiers: *Polysomes, *Seedlings, *DNA, *Messenger RNA, Incorporation, Ribosomes.

Relatively mild plant water stresses affect cell nuclei by inducing chromatin aggregation and polysome disappearance. Determinations of ribosome structure and amino acid uptake and incorporation were made on water stressed root tip cells. Sedimentation analyses of ribosome isolates showed that polysome fractions decreased to 8% in stressed tips relative to controls. These results were supported by electron-micrographs in which stressed root cells had no polysomes. Carbon-14 labelled amino acid uptake and incorporation into trichloroacetic acid was severely reduced in both water stressed intact seedlings and root tips. On the basis of these findings, a possible hypothesis of the underlying effects of water stress on root tip cell function is advanced: cellular dehydration causes nuclear DNA condensation, thereby decreasing m RNA synthesis. The extent of both phenomena is directly proportional to degree of water loss. Decreasing m RNA results in decreasing protoplasmic polysome populations thus reducing protein formation and producing various drought symptoms. Recovery on rehydration is dependent on the extent of damage during stress. (Casey-Arizona)
W71-02512

INTRASPECIFIC DIFFERENCES IN TEMPERATURE-INDUCED RESPIRATORY ACCLIMATION OF DESERT SALTBUSH,
California Univ., Riverside. Dept. of Agronomy.
For primary bibliographic entry see Field 02D.
W71-02514

TRITIUM COLLECTION AND EXTRACTION TECHNIQUES FOR PLANT-WATER RELATIONSHIP STUDIES,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 02D.
W71-02516

INFLUENCE OF SOIL TEMPERATURE, IRRIGATION AND AERATION ON HEMICYCLIOPHORA ARENARIA,
California Univ., Riverside.
S. D. Van Gundy, F. D. McElroy, A. F. Cooper, and L. H. Stolzy.
Soil Science, Vol 106, No 4, p 270-274, October 1968. 2 tab, 3 fig, 7 ref. NSF Grant GB-2394.

Descriptors: *Soil temperature, *Irrigation effects, *Aeration, *Nematodes, *Pest control, Citrus fruits, Vegetable crops, Soil-water-plant relationships, Arid lands, California, Sampling, Depth, Reproduction, Life cycles, On-site tests, Greenhouses, Environmental effects, Animal populations, Oxygen, Drying, Rates of application, Diffusion.
Identifiers: *Sheath nematode, *Soil suction, Coachella Valley (California), Imperial Valley (California).

The sheath nematode, Hemicycliophora arenaria Raski, is a relatively new nematode pest to California citrus. It is a native species found on an indigenous plant common in sandy washes and stream beds in the Coachella and Imperial Valleys--cheese bush. It parasitizes vegetable crops in greenhouse experiments, and under optimum conditions of 30 to 32.4 degrees C. and sandy soils, can produce large populations in 3 months. Increased frequency and amount of water application in field and greenhouse tests reduced population numbers of the nematode irrespective of soil temperatures. Oxygen diffusion rate measurements demonstrated that a drying period of 7 days between irrigations was required before there was relatively high and uniform oxygen distribution throughout the top 24 inches of soil. The interval of time between short cycle irrigations did not allow sufficient oxygen diffusion to the lower depths for growth of citrus roots and nematode reproduction. At shallow depths, the frequency interruption of nematode life cycle with 3-day irrigations had some influence on total nematode reproduction. Tables show nematode populations taken at monthly intervals in field soil, and effect of temperature and soil suction on nematode reproduction. Figures of monthly population density and days between irrigation, oxygen diffusion rates and relationship to irrigation frequency are included. (Popkin-Arizona)
W71-02517

FUNCTION AND GROSS MORPHOLOGY IN FISH,
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
Yu. G. Alecv.
Available from NTIS as TT-67-51391, $3.00 in paper copy, $0.95 in microfiche. Funnktsional'nye Osnovy Vneshnego Stroyen'ya Ryby. Israel Program for Scientific Translations, Jerusalem, 1969. 267 p.
Identifiers: *Fishes, *Morphology (Biology), *Physiology, Fishes, Sense organs, Adaptation (Physiology), Gravity, Motor reactions, Embryology, Nutrition, USSR, Ontogeny, Phylogeny.

The book represents a comprehensive approach in reviewing factors determining the outer organization of fish and deals also with the basic features involved with the dynamics of this organization in the course of ontogeny and phylogeny; the author analyzes the adaptations connected with the animal's movements, its disguise and protection, its catching of food and the provision of the normal function of the animal's sense organ receptors. Special attention is devoted to the review of adaptations associated with movements of the animal owing to the fact that the latter mostly display a most effective influence upon the exterior structure of fish; it is worth mentioning that these factors are examined insufficiently. The greater part of the author's original investigations is devoted to the study of these very complex adaptations. The study also covers adaptations connected with the animal's disguise. The significance of the latter phenomena has not been given adequate elucida-

tion and has not been viewed as factors determining the exterior structure of fish.
W71-02617

2J. Erosion and Sedimentation

SEDIMENT MEASUREMENT TECHNIQUES: RESERVOIR DEPOSITS,

ASCE Proceedings, Journal of the Hydraulics Division, Vito A. Vanoni, Chairman, Task Comm., Vol 96, No HY12, Paper 7781, p 2417-2446, December 1970. 30 p, 25 fig, 1 tab, 19 ref.

Descriptors: *Sedimentology, *Surveys, *Measurement, *Sampling, *Instrumentation, Sediment transport, Data collections, Sediments, Sounding, Acoustics, Nuclear meters, Reservoir silting.
Identifiers: *Sedimentation manual (ASCE).

A chapter on reservoir deposits was written for the ASCE Sedimentation Manual. Reservoir sediment surveys are defined. Guidelines are listed concerning how frequently the surveys should be run. Field equipment is described including sonic sounders; distance measuring apparatus, and auxiliary equipment. Piston core, gravity type, gamma probe, and other types of sediment deposit samplers are illustrated and described. Contour and range methods of reservoir sediment surveys are explained. Several methods of reservoir capacity computations are presented mathematically and graphically. (Knapp-USGS)
W71-02205

MOTION OF SINGLE PARTICLES IN ALLUVIAL CHANNELS,
Geological Survey, Fort Collins, Colo.
Neil S. Grigg.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7770, p 2501-2518, December 1970. 18 p, 12 fig, 4 tab, 8 ref, append.

Descriptors: *Sediment transport, *Tracking techniques, *Alluvial channels, *Hydraulic models, Radioactivity techniques, Tracers, Stochastic processes, Dispersion, Erosion, Sedimentation.
Identifiers: Single-particle tracking.

Movements of single sand-size radioactive particles were followed in a laboratory alluvial channel. Two sizes of bed material were used with experimental conditions limited to the ripple and dune bed forms of the lower flow regime. The frequency distribution of the particle step lengths was represented very well by the gamma distribution, and the frequency distribution of the particle rest periods was represented adequately by the exponential distribution. The mean step lengths related well to the stream power of the flow. The mean rest period related well to the celerity of the bed forms. A one-dimensional stochastic model for sediment dispersion predicted the mean distance traveled by the tracer particles but did not predict the rate of spreading of the tracer concentration distribution. (Knapp-USGS)
W71-02208

SEDIMENTS AND SEDIMENTARY PROCESSES OF EASTERN MISSISSIPPI CONE, GULF OF MEXICO,
Florida State Univ., Tallahassee. Dept. of Geology and Florida State Univ., Tallahassee. Dept. of Oceanography.
Ter-Chien Huang, and H. G. Goodell.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2070-2100, November 1970. 31 p, 11 fig, 5 tab, 15 ref.

Descriptors: *Sedimentation, *Gulf of Mexico, *Mississippi River, *Deltas, Sedimentary structures, Water chemistry, Geochemistry, Sediments, Suspended load, Bed load, Instrumentation, Surveys, Sands, Silts, Mud, Carbonate rocks, Geophysics, Profiles, Sounding, Sediment transport, Turbidity currents, Deposition (Sediments).
Identifiers: *Mississippi Delta, Mississippi cone.

The upper 6-7 m of sediment of the eastern Mississippi cone consists of gray silt and silty clay intercalated with a few layers of fine sand, topped by a 20-50-cm layer of yellowish-brown foraminiferal clay. Dating shows that the lower silty layers, which are the deposits of latest low sea-level stand, were deposited more rapidly than the upper foraminiferal clay. Sedimentation rates, which depend primarily on the rate of the detrital influx and sea-level change, average about 30 cm/1,000 years. The primary mechanisms of sediment transport are differential pelagic settling and low-flow-regime bottom currents, with many mass movements by sliding or slumping. Most of the structures associated with coarser materials are similar to structures formed by traction transport or by ripple migration in shallow water. Diagenetic solution of carbonate, is related to the degradation of organic matter. Solution is partly responsible for the abrupt decrease of carbonate downward, rearrangement of clay particles into secondary thin laminae, and the shortening of the distance between silt and sand layers. (Knapp-USGS)
W71-02209

GROWTH PATTERNS OF DEEP-SEA FANS,
Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
For primary bibliographic entry see Field 02L.
W71-02210

EFFECT OF DIAPIRISM ON SEDIMENTATION IN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C. Oceanography and Geophysics Branch.
For primary bibliographic entry see Field 02L.
W71-02212

MUD VOLCANO CLAY, TRINIDAD, WEST INDIES,
Columbia Univ., New York. Dept. of Geology.
Paul F. Kerr, Isabella M. Drew, and Darlene S. Richardson.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2101-2110, November 1970. 10 p, 7 fig, 3 tab, 29 ref.

Descriptors: *Sediment transport, *Sedimentary structures, *Structural geology, *Clays, *Quick clays, Sedimentation, Clay minerals, Mud, Volcanoes, Flow, Mudflows.
Identifiers: *Mud volcanoes, *Trinidad (W.I.), *Thixotropic clays.

Clay-mineral samples from two mud volcanoes on the island of Trinidad were compared with clay samples from the lower Cruse and Nariva Formations, through which the throats of the mud volcanoes are believed to have penetrated. The clay minerals are mixed-layer illite-montmorillonite and kaolinite. In the formation samples, illite is the larger part of the mixed-layer clay. Montmorillonite is preponderant in the clay from the mud volcanoes. All the clay samples examined, when water saturated, become thixotropic with the capacity to flow as a fluid. Thixotropic clay saturated with water becomes a highly mobile fluid with great transporting power. Where such a mobile mass accumulates along a partly broken anticlinal structure, any release of pressure will occur upward. A gas pocket, tectonic squeeze, or both will provide pressure to maintain upward motion. In this way the clay is extruded to form a mud volcano. Although moving vertically and supported by gas and tectonic pressure, the clay flowage has characteristics comparable to horizontal clay movement in landslides, in which motion is maintained by gravity. (Knapp-USGS)
W71-02213

A COMPUTER PROGRAM FOR THE CALCULATION OF HYDROMETER SIZE ANALYSIS,
University Coll. of North Wales, Bangor. Dept. of Physical Oceanography.
For primary bibliographic entry see Field 07C.
W71-02215

DISTRIBUTION AND TRANSPORTATION OF SUSPENDED SEDIMENT IN UPPER CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W71-02258

URBAN SOIL EROSION AND SEDIMENT CONTROL,
National Association of Counties Research Foundation, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-02276

BOTTOM STABILITY AND SEDIMENTARY PROCESSES AT LITTLE LAKE HARBOR, LAKE SUPERIOR,
United States Lake Survey, Detroit, Mich.
For primary bibliographic entry see Field 02H.
W71-02293

MECHANICS OF DEBRIS AVALANCHING IN SHALLOW TILL SOILS OF SOUTHEAST ALASKA,
Forest Service (USDA), Juneau, Alaska. Pacific Northwest Forest and Range Experiment Station.
Douglas N. Swanston.
USDA Forest Service Research Paper PNW-103, 1970. 17 p, 8 fig.

Descriptors: *Debris avalanches, *Landslides, *Mass wasting, *Glacial soils, *Slope stability, Soil erosion, Engineering geology, Soil engineering, Alaska, Clear-cutting.
Identifiers: Southeast Alaska, Soil creep.

Three areas with recent debris avalanches in a shallow, permeable till soil common to southeast Alaska were instrumented and analyzed using established methods of soil mechanics. These studies indicated that a combination of complete saturation during periods of excessive rainfall, naturally unstable slopes (S34 deg.), and the loss of the anchoring effect of tree roots in an otherwise cohesionless soil were the principal causes of the debris avalanching. Areas of general slope instability in a watershed can be located by constructing an isosinal contour map. The critical contour in the study area was 0.6, the sine of 37 deg.
W71-02306

PROCEEDINGS OF THE NATIONAL CONFERENCE ON SEDIMENT CONTROL.
Dept. of Housing and Urban Development, Washington, D.C. Office of Metropolitan Planning and Development.
For primary bibliographic entry see Field 04D.
W71-02425

THE DISTRIBUTION OF Pb, Ag, Sn, Tl, AND Zn IN SEDIMENTS ON ACTIVE OCEANIC RIDGES,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 02K.
W71-02436

POTAMOLOGY DATA COLLECTION ON LOWER MISSISSIPPI RIVER,
Army Engineer District, Vicksburg, Miss. River Stabilization Branch.
For primary bibliographic entry see Field 02E.
W71-02438

STREAM SEDIMENT: AN ENVIRONMENTAL PROBLEM,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 04C.
W71-02443

PHOSPHATE EXCHANGE WITH SEDIMENTS: ITS ROLE IN THE PRODUCTIVITY OF SURFACE WATERS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 02H.
W71-02520

2K. Chemical Processes

ELECTROLYTIC CONDUCTANCE AND THE CONDUCTANCES OF THE HALOGEN ACIDS IN WATER,
National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
For primary bibliographic entry see Field 01B.
W71-02218

WATER GEOCHEMISTRY, HOG CREEK BASIN, CENTRAL TEXAS,
Baylor Univ., Waco, Tex. Dept. of Geology.
For primary bibliographic entry see Field 05A.
W71-02219

TRITIUM IN STREAMS IN THE UNITED STATES, 1961-1968,
Geological Survey, Wash., D.C.; Weather Bureau, Silver Spring, Md. Office of Hydrology; and Massachusetts Univ., Amherst. Coll. of Agriculture.
For primary bibliographic entry see Field 05B.
W71-02434

THE DISTRIBUTION OF Pb, Ag, Sn, Tl, AND Zn IN SEDIMENTS ON ACTIVE OCEANIC RIDGES,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
Arthur Horowitz.
Marine Geology, Vol 9, No 4, p 241-259, November 1970. 19 p, 5 fig, 7 tab, 30 ref.

Descriptors: *Water chemistry, *Geochemistry, *Sediments, *Distribution patterns, *Oceans, *Sea water, Sedimentation, Oceanography, Marine geology, Topography, Geophysics, Sedimentation rates, Deposition (Sediments), Movement, Sediment distribution.
Identifiers: *Ocean ridges, Tectonic activity.

Ninety-five sediment samples, taken from traverses across active oceanic ridges were analyzed by emission spectrography for Pb, Ag, Sn, Tl, and Zn. The concentration patterns indicate that processes associated with active oceanic ridges partially affect the distribution of Pb, Tl and Zn. The distribution of Ag is affected only in the Pacific and western Indian Ocean. Sn distribution is not related to any active ridge process. The covariation between distance from a ridge and concentration indicates that the ridge effects are not more than 10%. Average concentrations (weighted by sedimentation rates) were determined for Pb, Ag, Sn, Tl, and Zn in parts of the Pacific, the Atlantic, and the Indian Oceans. On the basis of the high concentrations of Pb, Tl, and Zn in the Pacific, the intermediate concentrations in the Indian Ocean, and the low concentrations in the Atlantic, it is inferred that the East Pacific-Antarctic Ridge system is the most active, the north Mid-Atlantic Ridge is the least active, and the Indian Ocean Ridge system is of intermediate activity. This seems to be in accord with geophysical data for the same regions. (Knapp-USGS)
W71-02436

AUTOMATE KJELDAHL ANALYSES OF NITROGENOUS MATERIALS IN AQUEOUS SOLUTIONS,
National Inst. for Water Research, Pretoria (South Africa).
J. E. Harwood, and D. J. Huyser.
Water Research, Vol 4, No 8, p 539-545, August 1970. 7 p, 2 fig, 26 ref.

Descriptors: *Ammonia, *Nitrogren, *Chemical analysis, *Spectrophotometry, Instrumentation, Automation, Laboratory tests, Measurement.
Identifiers: Automated nitrogen analysis.

A single manifold was developed that could be used for Kjeldahl analyses over a wide range of nitrogen contents. An automated method to determine total nitrogen on liquid samples containing a wide range of nitrogen is based on the separation of ammonia-nitrogen by distillation from the acid digest prior to the determination of the ammonia-nitrogen content. Sensitivity may be altered by changing reagents. The most sensitive method covered the range 0-20 mg per liter with a 15 mm flowcell and no range expansion. (Knapp-USGS)
W71-02439

DETERMINATION OF PENTACHLOROPHENOL IN ORGANIC TISSUES AND WATER,
Swedish Water and Air Pollution Research Lab, Stockholm.
For primary bibliographic entry see Field 05A.
W71-02440

WATER RESOURCES DATA FOR COLORADO-1968: PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.

Report available from District Chief, Water Resources Div., US Gelogical Survey, Denver Federal Center, Denver, Colo. 80225. Geological Survey Duplicated Basic Data Report, 1969. 97 p, 3 fig, 21 ref.

Descriptors: *Water quality, *Data collections, *Surface waters, *Groundwater, *Colorado, Chemical, analysis, Gaging stations, Streams, Streamflow, Discharge measurement, Sediments, Temperature.
Identifiers: *Basic data, Water quality records.

Water quality data for surface waters in Colorado for the 1968 water year (October 1, 1967 to September 30, 1968) are presented. Data for a few water quality stations in bordering states and selected data on the chemical quality of groundwater in Colorado are also included. Water quality information is presented for chemical quality, fluvial sediment, and water temperatures. The chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-adsorption-ratio, specific conductance, and pH. Fluvial sediment information is given for suspended-sediment discharges and concentrations and for particle size distribution of suspended sediment and bed material. Water temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. Of the 100 Irrigation Network stations selected in 1952 (Water Resources Council), 77 are currently operated and the results are published in this report. The stations are at or near certain streamflow gaging sites west of the main stem, Mississippi River. These data are for evaluation of chemical quality of applied water and the quality changes resulting from drainage of irrigated lands. Detailed definitions are given of technical terminology used in the report. (Woodard-USGS)
W71-02470

THE CATIONS OF THE COTTON PLANT IN SODIUM SUBSTITUTED POTASSIUM DEFICIENCY,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02I.
W71-02504

A STUDY OF THE HAMRA SOIL ASSOCIATION OF ISRAEL,
Technion - Israel Inst. of Tech., Haifa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02G.
W71-02519

2L. Estuaries

SEDIMENTS AND SEDIMENTARY PROCESSES OF EASTERN MISSISSIPPI CONE, GULF OF MEXICO,
Florida State Univ., Tallahassee. Dept. of Geology and Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 02J.
W71-02209

GROWTH PATTERNS OF DEEP-SEA FANS,
Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
William R. Normark.
American Association Petroleum Geologists Bulletin, Vol 54, No 11, p 2170-2195, November 1970. 26 p, 25 fig, 2 tab, 46 ref.

Descriptors: *Sedimentation, *Deltas, *Sedimentary structures, *California, Pacific Ocean, Channel morphology, Deposition (Sediments), Sediment transport, Turbidity currents, Continental slope, Surveys, Sounding, Profiles.
Identifiers: *Deep-sea fans.

Mapping of La Jolla and San Lucas deep sea fans, off California and Baja California, with the deep-towed instrument package developed at Marine Physical Laboratory of the Scripps Institution of Oceanography details the fine-scale morphology, structure, and internal fill of the fan-valleys and suggests the growth patterns of these fans. A model for deep-sea fan growth based on this study predicts that deposition on a fan will be localized in a suprafan at the end of large, leveed valleys commonly found on, and generally confined to, the upper reaches of deep-sea fans. The suprafan normally is on the midfan and is characterized by numerous smaller distributary channels. Rapid aggradation in the suprafan coupled with migration and meandering of the channels produces a surface marked by isolated depressions or channel remnants. Uniform deposition, producing a symmetrical half-cone morphology, results from the shifting through time of fan-valleys across the area of the fan. (Knapp-USGS)
W71-02210

ABOVE-BOTTOM ACOUSTIC REFLECTIONS, MISSISSIPPI RIVER DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
L. D. Wright.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2208-2213, November 1970. 6 p, 3 fig, 1 tab, 15 ref. ONR Project Nonr 1575 (03), Task No 388002.

Descriptors: *Sounding, *Salinity, *Mississippi River, *Density stratification, Stratified flow, Density currents, Tides, Flow, Tidal effects, Deltas, Surveys, Currents (Water), Water circulation, Acoustics, Bathymetry, Fathometers.
Identifiers: *Mississippi delta.

Acoustic fathometric reflections from depths well above the bottom are phenomena commonly observed off the passes of the Mississippi River. These reflections previously have been attributed to an ooze resulting from flocculation. Systematic observations failed to disclose the presence of the ooze or 'sludge' but indicated that the reflections result from strong salinity contrasts. The degree of these contrasts and the presence of the reflections are correlative with the direction of tidal flow. (Knapp-USGS)
W71-02211

EFFECT OF DIAPIRISM ON SEDIMENTATION IN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C. Oceanography and Geophysics Branch.
Jack R. Walker, and H. Robert Ensminger.
American Association of Petroleum Geologists Bulletin, Vol 54, No 11, p 2058-2069, November 1970. 12 p, 13 fig, 1 tab, 4 ref.

Descriptors: *Sedimentation, *Structural geology, *Gulf of Mexico, *Geophysics, *Seismic studies, Profiles, Mapping, Instrumentation, Data collections, Sounding, Oil fields, Sea water, Velocity, Deposition (Sediments).
Identifiers: *Diapirism, *Salt domes.

In 1969 an extensive geophysical investigation was made of the Gulf of Mexico. One of the principal measurement systems used was the medium-frequency (3,500 Hz), high-resolution seismic profiler. The seismic profiles provide information about the effects on recent sediments of deposition, water-energy levels, and diapirism. The various stages of sediment deformation and disruption associated with active diapirism and of faulting resulting from salt dome emplacement are observable. The medium-frequency seismic system is a useful tool to aid the study of concurrent deposition during active diapirism and the subsequent environmental effects at the sea floor. Marine sediments that accumulate above an active diapir are profoundly affected by the distortion of the sea floor induced by growing salt intrusions. The accumulation of sediments above diapirs also is related directly to the rate of sediment influx and the energy level of the water. (Knapp-USGS)
W71-02212

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.

For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $1.75. House Document No 91-274, 91st Congress, 2d Session, January 1970. 91 p, 16 photo, 11 map.

Descriptors: *Estuaries, *Water pollution effects, *Estuarine environment, *Management, Marsh management, Wildlife management, Habitat improvement, Recreation facilities, Industrial wastes, Planning, Legal aspects, State governments, Regulations, Preservation, Great Lakes, Coastal marshes, Investigations, Water rights, National seashores.
Identifiers: *Estuary P rotection Act, *National estuary study, Land-water interface, Coastal management system.

This is the main report of a 7 vol series prepared by the Department of the Interior in response to the Estuary Protection Act (PL 90-454). Report documents estuary importance and the severity of their modification by man. It demonstrates urgent needs for Congressional enactment of Interior's bill for a comprehensive Coastal Zone Management System. Except for some in Alaska, everyone of the Nation's estuaries has been modified; 23% severely, 50% moderately, and 27% slightly. Half the population utilize them for recreation, including millions who migrate from inland states to fish, sail, etc. Estuaries are favorite places for industry, which finds land cheap, water supply and transportation easy to develop, and waste disposal convenient. Residential developers find it very profitable to dredge and fill estuary areas for affluent people who wish to live near the water. A summary is given of comments from state agencies expressing their views on the feasibility and desirability of establishing a nationwide system of estuarine areas. Almost 75% of them have experienced a need for protection through acquisition where legal controls were inadequate, but only about half the States favored Federal acquisition, mostly with qualifications. (Lang-USGS)
W71-02217

EFFECTS OF PROPOSED BARRIERS ON HURRICAN SURGE HEIGHTS - REPORT 1 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02243

EFFECTS OF PROPOSED BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 2 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02244

EFFECTS OF PLAN 2 ALPHA AND PLAN 2 GAMMA BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 3 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02245

DISTRIBUTION AND TRANSPORTATION OF SUSPENDED SEDIMENT IN UPPER CHESAPEAKE BAY,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
J. R. Schubel.
Chesapeake Bay Institute Technical Report 60, Reference 69-13, Johns Hopkins University, November 1969. 29 p, 12 fig, 16 ref.

Descriptors: *Estuaries, *Sediment transport, *Provenance, Streamflow, Sedimentation, Currents (Water), Suspended load, Scour, Suspension, Tidal effects, Turbidity, Floods.
Identifiers: Chesapeake Bay, Susquehanna River.

In the upper reaches of the Chesapeake Bay there are two distinctive distributions of suspended sediment, and associated patterns of sediment transport. During the spring freshet the Susquehanna River overpowers the characteristic net non-tidal estuarine circulation in the upper 20-30 km of the estuary and the net flow and sediment transport are seaward at all depths. The marked decrease seaward of the concentration of suspended sediment in the upper Bay reveals the close link, during the freshet, between the suspended sediment population and the principal 'ultimate' source of sediment--the Susquehanna River. With subsiding river flow the net non-tidal estuarine circulation is reestablished in the upper Bay, and a turbidity maximum is formed. The high concentrations of suspended sediment, greater than those either farther upstream in the source river or farther seaward in the estuary, are produced and maintained primarily by the periodic resuspension of bottom sediment by tidal scour, and by the sediment trap created in the upper reaches of the estuarine circulation regime. (Knapp-USGS)
W71-02258

TRANSIENT CHARACTERISTICS OF SALT-WATER WEDGE,
Saitama Univ., Urawa (Japan). Dept. of Foundation Engineering.
For primary bibliographic entry see Field 02F.
W71-02262

CONTROL OF SEA WATER LEVEL IN COASTAL POROUS MEDIA BY MEANS OF DOUBLE PUMPING,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
Yoshiaki Iwasa, and Hitoshi Takeuchi.
French synopsis. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 391-400, 1969. 10 p, 14 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Saline water-freshwater interfaces, *Aquifers, Porous media, *Mathematical models, Equations, Computers, Withdrawal, Pumping, Water resources, Water supply.
Identifiers: Coastal aquifers, Double pumping.

The mathematical theory of the selective withdrawal for fresh and sea waters by means of double pumping under several assumptions is studied. The numerical calculations for the mathematical model derived are made by the electronic computer. The results obtained are also compared with the experimental verification made in an experimental basin at the hydraulics laboratory. The double pumping technique should be useful in the utilization of fresh water in coastal aquifers. (Woodard-USGS)
W71-02265

PHENOMENA OF TURBULENT HORIZONTAL TRANSPORT AND DIFFUSION IN THE TIDAL COASTAL SEAS AND APPLICATION TO THE ENGLISH CHANNEL,
Grenoble Univ. (France). Faculte des Sciences.
Jean Louis Hyacinthe.
Available from NTIS as N70-17225, $3.00 in paper copy, $0.95 in microfiche. 1969. 158 p, 20 fig, 87 ref.

Descriptors:
Identifiers: *Tides, *Transport properties, *Turbulent diffusion, *Waste disposal, Coasts, Incompressible fluids, Magnetohydrodynamics, Mathematical models, Mixing length flow theory, Radioactive wastes, Rotating fluids, Scale effect, Seas, Stratified flow, Turbulent mixing.

Classical results on the homogeneous or isotropic turbulent transport properties of an incompressible fluid are compared. Theoretical and experimental results for marine and oceanic turbulent flows and horizontal turbulent transport are summarized and applied to tidal coastal waters, especially those of the English Channel. A direct experiment using buoys and coloring materials was carried out in order to choose between different hypotheses and scale laws. A rotating hydraulic model was designed to simulate tidal effects in the English Channel in order to evaluate nuclear waste disposal sites.
W71-02305

SEAWATER INTRUSION LENGTH IN STRATIFIED ESTUARIES,
Norsk Institutt for Vannforskning, Oslo.
Y. F. Ozturk.
Water Research, Vol 4, No 7, p 477-484, July 1970. 8 p, 5 fig, 1 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Stratified flow, *Length, *Model studies, Saline water-Freshwater interfaces, Mixing, Sea water, Equations, Theoretical analysis, Density stratification, Velocity, Streamflow, Flow rates, Tides, Meteorology, Channel morphology.
Identifiers: Stratified estuaries.

The hydrodynamical evaluation of the sea-water intrusion length is based on the theory of density currents. Although the geometry of estuaries may vary from place to place the experimental estuaries used for this purpose are usually the channels of constant shape which do not include the influence of the local variations in depth, width, velocity and salinity. For the analysis of theoretical principals of sea-water intrusion length, the estuary of rectangular cross-section containing distinctly separated river-water and sea-water layers, is considered. The validity of the experimental material presented rests on the simplified estuary models, in which the effect of tide, estuary geometry and Reynolds number for the river have been neglected during

the experiments. It is concluded that by some developed model estuary or sufficient data obtained from the real estuary, the determination and introduction of estuary shape factor and Reynolds number for the river into the sea-water intrusion length equation may be possible. For the practical evaluation of arrested sea-water wedge lengths in any stratified estuary, the knowledge about the densities of sea water and river water, kinematic viscosity of river water, depth of river at the estuary mouth, velocity of river flow at the tip of wedge, and corresponding length of sea-water wedge is sufficient. (Woodard-USGS)
W71-02435

THE DISTRIBUTION OF Pb, Ag, Sn, Tl, AND Zn IN SEDIMENTS ON ACTIVE OCEANIC RIDGES,
Miami Univ., Fla. Inst. of Marine and Atmospheric Sciences.
For primary bibliographic entry see Field 02K.
W71-02436

HYDROCARBON POLLUTION OF EDIBLE SHELLFISH BY AN OIL SPILL,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02475

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME I,
Gulf Universities Research Corp., Galveston, Tex.
James M. Sharp, Dan E. Feray, Ronald F. Bearden, Thomas W. Bilhorn, and Joseph R. Crump.
Available from NTIS as PB-193 722, $3.00 in paper copy, $0.95 in microfiche. Summary Technical Report, August 1970. 73 p, 9 fig. ESSA Contract E-189-69 (N).
Identifiers: *Estuaries, *Economics, Management planning, Costs, Recreation, Weather forecasting, Storms, Minerals, Aquatic animals, Natural resources, Erosion, Water pollution, Sedimentation, Mexico Gulf, Gulf Coast (US), Coastal zone management.

An initial effort was made to determine the economic benefits to be derived from a description and prediction of the dynamic behavior of estuaries, or inland water areas, along the United States margin of the Gulf of Mexico. Such services have not yet been established; therefore, service costs were derived from conceptual design studies and estimates of operation and maintenance requirements. Since the services have not been in use, data have not been accumulated which would permit the determination of economic benefits on the basis of statistical treatment. (See also W71-02607).
W71-02606

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME II, APPENDICES,
Gulf Universities Research Corp., Galveston, Tex.
Thomas E. Hawkins.
Available from NTIS as PB-194 077, $3.00 in paper copy, $0.95 in microfiche. Appendixes to Volum I, January 1970. 151 p.
Identifiers: *Economic development, *Benefit cost analysis, *Estuaries, Economic development, *Management planning, *Econometrics, Mathematical models, Inland waterways, Beaches, Dredging, Sediment transport, Temperature, Salinity, Water flow, Remote sensors, Tidegages, Shallow water, Data processing systems, *Gulf Coast estuaries, Galveston Bay, *Estuarine dynamics.

The need for knowledge of estuarine dynamics (Need for mass flow measurements; need for water level measurements; need for water temperature measurements; need for systems approach) Overall program concepts (The instrumentation concept; the model concept); Program and program costs (Galveston Bay program definition; Galveston Bay program costs; long-term program and program costs). (See also W71-02606).
W71-02607

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

BUDGETARY CAPITAL COST ESTIMATES OF 1- TO 10-MGD MULTISTAGE FLASH DISTILLATION PLANTS FOR DESALTING SEA-WATER,
Oak Ridge National Lab., Tenn.
R. A. Greene, S. A. Senatore, and R. A. Ebel.
Available from NTIS as PB-193 689, $3.00 in paper copy, $0.95 in microfiche. ORNL-TM-3083, August 1970. 40 p, 12 fig, 14 tab, 2 ref. AEC Contract W7405-Eng-26, OSW Agreement No 14-30-2535.
Identifiers: *Desalination, Costs, *Distilling plants, Sea water, Programming (Computers), Pipes, Fixed investment.

By means of a computer program, capital costs were estimated for several multistage flash (MSF) desalting plants in the 1-10-Mgd size range. The plant design was assumed to be similar to the OSW 'Universal Plant' design. The report tabulates changes in capital cost estimates as a result of variations in performance ratio, tubing price, copper-nickel vs titanium tubing, flow velocity in tubes, number of vessels in the plant, number of stages, and seawater feed temperature. For all capital cost summaries, the tabulations show a breakdown into the following categories: seawater intake, sitework, buildings, evaporator, shell, pumps and motors, valves and piping, chemical systems, instruments, electrical, deaerator, brine heater, and indirect costs.
W71-02609

3B. Water Yield Improvement

GROUND RAINFALL DATA FOR THE 1968 FLORIDA CLOUD SEEDING EXPERIMENT,
Environmental Data Service, Silver Spring, Md.
B. G. Holzman, and Thom Marcella.
Available from NTIS as PB-194 366, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum EDSTM 17, August 1970. 15 p, 11 fig, 2 ref.

Descriptors:
Identifiers: *Cloud seeding, Florida, Meteorological charts, Wind, Fronts (Meteorology), Velocity.

Maps of ground rainfall data are depicted for the Research Laboratories' 1968 Florida cloud seeding experiment. These maps are for information only, and no conclusions are drawn for the verification of enhanced rainfall from seeded clouds.
W71-02301

A STUDY OF THE PRODUCTION AND DETECTION OF ARTIFICIAL ICE NUCLEI,
Denver Research Inst., Colo.
Norihiko Fukuta, L. F. Evans, Young H. Paik, William A. Schmeling, and Louise A. Walter.
Available from NTIS as PB-194 129, $3.00 in paper copy, $0.95 in microfiche. Final Report for Bureau of Reclamation, July 1970. 65 p, 8 tab, 19 fig, 25 ref. BuRec Contract No 14-06-D-6444.

Descriptors: Weather modification.
Identifiers: *Cloud seeding, Artificial precipitation, *Ice, Nucleation, Crystal growth, Detection, Aerosol generators, Spraying, Cloud physics, Vapors, Condensation nuclei, Freezing, Silver iodide, Supercooling.

The present major task of weather modification engineering is the optimization of the seeding effect which depends on the purpose of seeding and the type and condition of the given cloud system. Toward this objective, a study of many subjects has been carried out concerning the production and detection of ice nuclei, and growth of the formed ice crystals. Major achievements are as follows: development of organic ice nuclei generators; development of airborne volatile liquid ice crystal generators; development of a slow activation ice nucleus counter; and development of ice crystal growth theory from vapor.
W71-02304

3C. Use of Water of Impaired Quality

CITY OF SAN DIEGO WATER RECLAMATION STUDY FOR BALBOA PARK AND MISSION BAY PARK.
Boyle Engineering, San Diego, California.
For primary bibliographic entry see Field 05D.
W71-02287

HODGES V TOWN OF BLUFF CITY (ACQUISITION OF WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02327

3D. Conservation in Domestic and Municipal Use

POTOMAC-SHENANDOAH RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN: VOLUME 5-ENGINEERING DEVELOPMENT ALTERNATIVES.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W71-02216

HARVEY REALTY CO V BOROUGH OF WALLINGFORD (RIPARIAN RIGHTS AND PROTECTION OF PUBLIC WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-02314

PUBLIC WATER SUPPLIES IN LOUISIANA,
Geological Survey, Baton Rouge, La.
Don C. Dial.
Louisiana Department of Public Works Basic Records Report No 3, 1970. 460 p, 14 fig, 1 tab, 22 ref.

Descriptors: *Municipal water, *Data collections, *Water supply, *Water utilization, *Louisiana, Groundwater, Aquifers, Surface waters, Water sources, Mississippi River, Lakes, Public utilities.
Identifiers: *Public water supplies, Basic data.

This report contains water-supply information for 291 municipalities, parish water districts, and most privately owned water districts. Groundwater is used by 246 municipalities and water districts, and surface water by 45. The following information, if applicable, is given for each facility: owner, source of supply, population, number of services, treatment procedure, pumpage, well logs, and chemical analyses of water samples. Mechanical analyses of sand samples and aquifer-test results are included to the extent that such results are available. Fresh water is available in 6 major aquifer systems ranging in age from Paleocene to Pleistocene. Southeastern parishes are underlain by as many as 15 fresh-water-bearing sands, and most towns obtain supplies from two or more aquifers. Large quantities of water are provided by the mississippi and Atchafalaya Rivers. Almost all towns downstream from Iberville Parish use water from the Mississippi, which must be treated for public needs. Intrusion of salty water from the Gulf must

be monitored in the lower reaches. A total of 377 mgd of water is pumped for Louisiana public supplies. (Lang-USGS)
W71-02451

3E. Conservation in Industry

PUBLIC WATER SUPPLIES IN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 03D.
W71-02451

3F. Conservation in Agriculture

GLASS-FIBER REINFORCED POLYESTER LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08G.
W71-02300

HYDROLOGY OF SPRAY-RUNOFF WASTE WATER TREATMENT,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W71-02437

GRAZING STUDIES IN THE ARID AND SEMI-ARID ZONES OF RAJASTHAN. VII: UTILIZATION OF VEGETATION COVER, GRAZING BEHAVIOUR OF SHEEP AND SEASONAL VARIATION OF CRUDE PROTEIN CONTENT OF PLANTS IN DIFFERENT PASTURES,
Central Arid Zone Research Inst., Jodhpur (India).
A. K. Chakravarty, Ram Ratan, and K. C. Singh.
Annals of Arid Zone, Vol 9, No 1, p 10-16, March 1970. 2 fig, 4 tab, 1 ref.

Descriptors: *Forage grasses, *Arid lands, *Grazing, *Sheep, Ecology, Forage palatability, Pasture management, Plant groupings, On-site investigations, Xerophytes, Herbivores, Environmental effects, Proteins, Rainfall, Animal behavior, Data collections, Monthly, Seasonal, Semiarid climates, Range grasses, Variability, Vegetation effects.
Identifiers: *India, *Protein content (Crude), *Basal cover, Annual grasses, Perennial grasses.

In arid zones, knowledge of the overall value of herbage in different seasons is important for sheep farming. Utilization and crude protein content of pasture plants and ewe grazing behavior were studied for 10.5 months in 4 different pasture paddocks sown with various combinations of Rajasthan range grasses. During this period, there were 6 months of no rainfall and 4 months of over 60 mm. Monthly data were recorded on crude protein content and basal cover before and after grazing. General protein status is comparatively low except during the July-September rainy season. Over the year, crude protein percentages varied from 2.8-9.2 for perennials and from 12.4-17.3 for the better annuals. In terms of grazing stress resistance and basal cover increase, the most promising grasses, in order, were Cenchrus ciliaris, C. setigerus and Lasiurus sindicus. Most of the annuals appeared during the rainy season and the most palatable were Brachiaria ramosa, C. microphyllus, Indigofera cordifolia and I. linifolia. (Casey-Arizona)
W71-02501

BROWN STEPPE SOIL IN THE UPPER PART OF WADI EATEL (NORTHWEST TRIPOLITANIA),
Institute for Soil Research, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02G.
W71-02502

SPECIALIZATION OF AGRICULTURE IN RELATIVELY SIMILAR NATURAL ENVIRONMENTS OF THE USSR AND THE UNITED STATES,
Moscow State Univ. (USSR).
A. Ye. Granovskaya.
Translated from: Vestnik Moskovskogo Universiteta, Geografiya, No 4, p 79-90, 1968. Soviet Geography: Review and Translation, Vol 9, No 8, p 830-837, 1968. 1 fig, 7 ref.

Descriptors: *Geographical regions, *Soil types, *Climatic zones, *Regional analysis, Temperature, Water balance, Arid lands, Semiarid climates, Humid areas, Comparative productivity, Wheat, Forages, Dairy industry, Montana, North Dakota, Minnesota, Chernozems, Chestnut soils, Forest soils, Podzols, Agriculture, Grazing, Crop production, Data collections, Grasslands, Grains (Crops), Land use.
Identifiers: *USSR, *Temperature-sum isolines, *Comparative regional studies, Animal production.

Agricultural land-use comparisons between differing countries require some means of standardizing the physical attributes of comparable regions. Minor civil divisions in the U. S. (counties) and the USSR (rayons) were related on the basis of soil types and climate (temperature and moisture conditions). In each geographical zone one civil division from each country was compared. The 4 similar zones studied were: (1) dry steppe and chestnut soils, (2) moderately dry steppe and chernozem soils, (3) broadleaf forest and gray forest soils and (4) needleleaf forest and sod-podzolic soils. The comparisons suggest that agricultural differentiation by physical zone is quite different in the two countries. Animal products predominate in all U. S. zones except the very dry steppe where grains were sharply dominant. Grain yields, dairying and forage crops increased along the gradient of negative to positive water balance. In the USSR, such interzonal differences were less pronounced in forage production while crop and grain production rose markedly from dry to humid areas. The Soviets relegate animal production to a secondary role and derive their principle income from bread grains and industrial row crops. (Casey-Arizona)
W71-02510

HOW GREEN IS THE GREEN REVOLUTION,
For primary bibliographic entry see Field 06B.
W71-02513

INFLUENCE OF SOIL TEMPERATURE, IRRIGATION AND AERATION ON HEMICYCLIOPHORA ARENARIA,
California Univ., Riverside.
For primary bibliographic entry see Field 02I.
W71-02517

USE OF POULTRY MANURE FOR CORRECTION OF Zn and Fe DEFICIENCIES IN PLANTS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 05D.
W71-02717

DISPOSAL OF DAIRY CATTLE WASTES BY AERATED LAGOONS AND IRRIGATION,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W71-02720

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02202

FLOOD PLAIN INFORMATION, ROCKY AND WOLF CREEKS, MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.

Corps of Engineers Flood Plain Report, June 1970. 48 p, 24 fig, 52 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Regional flood, Flood forecasting, Flood control, Streamflow, Flow measurement, Historic flood.
Identifiers: *Flood records, Standard project flood, Intermediate regional flood.

Flooding along Rocky and Wolf Creeks in and near Macon in Bibb County, Georgia is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W71-02214

EFFECTS OF PROPOSED BARRIERS ON HURRICAN SURGE HEIGHTS - REPORT 1 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02243

EFFECTS OF PROPOSED BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 2 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02244

EFFECTS OF PLAN 2 ALPHA AND PLAN 2 GAMMA BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 3 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W71-02245

HYDRODYNAMICS OF FLOW IN POROUS MEDIA,
Technische Universitaet, Dresden (East Germany).
Ludwig Luckner, Gunther Mueller, and Joachim Quast.

French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 411-421, 1969. 11 p, 9 fig, 11 ref.

Descriptors: *Groundwater movement, Seepage, *Underseepage, *Levees, *Dams, Mathematical models, Equations, Aquifer characteristics, Flow, Infiltration, Hydraulic gradient, Leakage, Permeability, Water levels, Drainage.

Mathematical models of some typical sections of groundwater flow fields (confined flow, leaky water-bearing strata, flow to incomplete ditches, series of wells, etc.), with the fundamentals of the derivation of these mathematical relations, as well as with the interlacing laws dealing with these sections, are presented. The practical use of hydraulic network schemes is described using dam and dike seepage as an example and it is shown that this method can be used for solving very complex flow problems. It is demonstrated that this method of calculation can be used also for geohydraulic problems of underseepage in the case of massive hydraulic structures and for problems of bank filtration, artificial groundwater enrichment, opencast mine drainage, and many other problems. (Woodard-USGS)
W71-02260

FILTRATION CALCULATIONS OF HORIZONTAL AND VERTICAL DRAINAGES IN NONUNIFORM STRATIFIED SOILS,
Akademiya Nauk URSR, Kiev.
For primary bibliographic entry see Field 02G.
W71-02270

FLOOD PLAIN INFORMATION, CITY OF ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA, FOURMILE RUN.
Corps of Engineers, Baltimore, Maryland.

Report, October 1968. 38 p, 11 fig, 7 tab.

Descriptors: *Flood forecasting, *Flood plains, *Flood damage, *Storm runoff, *Urbanization, Maximum probable flood, Planning, Flood control, Flood plain zoning, Floodproofing, Runoff, Virginia, Streamflow forecasting, Drainage, Regional flood, Land development, Flash floods.
Identifiers: *Fourmile Run, Arlington County, Alexandria, Arlandria.

Flooding was studied on the lower 3 miles of Fourmile Run, a floodway draining 18.5 square miles that flows 9 miles through Arlington County, along the northern boundary of Alexandria, Virginia, and discharges into the Potomac River downstream of Washington National Airport. During the largest flood of record, in August 1963, damage to business properties in a four-block stretch of Arlandria was estimated at more than one million dollars. Two significant phases are covered of the Fourmile Run flood problem: (1) the largest known floods, and (2) probable future floods. Estimates are made of the maximum velocities, discharge rates, and flood depths that would result from a flood having a 100 year average recurrence interval, and from the maximum probable flood that could ever be anticipated in the area. This latter flood would top the flood depth of record by 10.3 feet on Mount Vernon Avenue in Arlandria, and discharge 25,000 cfs at its peak. The report is intended to provide the basis for further study and planning by Arlington County and Alexandria to develop solutions. The report contains maps, profiles and cross-sections that indicate the extent of future flooding anticipated. These can be used to guide and plan land developments, and to formulate zoning ordinances and subdivision regulations. They can also be used in planning flood protection works. (Poertner)
W71-02285

REPORT ON FOURMILE RUN FLOODING, ALEXANDRIA, VIRGINIA.
Greeley and Hansen, Chicago, Illinois.
For primary bibliographic entry see Field 08A.
W71-02286

APPLICATION OF GILLESPIE (COMPENSATION FOR DAMAGE CAUSED BY INCREASE IN VOLUME OF FLOW).
For primary bibliographic entry see Field 06E.
W71-02295

CHELTENHAM AND ABINGTON SEWERAGE CO V PUBLIC SERVICE COMM'N (OWNERSHIP OF STORM DRAINAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-02309

THE EFFECTIVENESS OF FLOOD CONTROL STRUCTURES OF THE LOWER MINNESOTA RIVER WATERSHED DISTRICT.
Lower Minnesota River Watershed District, Burnsville.

Available from NTIS as PB-196 114, $3.00 in paper copy, $0.95 in microfiche. Lower Minnesota River Watershed District and Office of Water Resources Research Cooperative Report, July 1970. 136 p, 61 fig, 7 tab, 22 ref, 3 append. OWRR Project C-1239 (No 1602) (1).

Descriptors: *Flood control, *Flood protection, *Flood plain zoning, *Non-structural alternatives, *Minnesota, Floodproofing, Regulation, Zoning, Building codes, Flood plains, Overflow, River basin development, Cost-benefit analysis, Levees, Channel improvement, Frequency analysis, Flood damage, Data collections.
Identifiers: *Minnesota River.

Flood protective structures in the Lower Minnesota River Watershed District, properly planned and constructed, are economical in providing protection against potential floods from the Minnesota River only for existing installations. New construction in the flood plain should include flood protection by proper location of structures as an integral part of the original design. In most cases, capital improvements should be made above the flood plain and far enough away from the main channel of the Minnesota River so as not to unduly restrict flood flows. Proper flood plain management and zoning could eliminate the need for structural measures of flood protection. Dikes, bulkheads, sandbagging, dams, and other structures would not be necessary if the flood plain were developed according to sound flood plain management principles. There is no economic necessity for flood protective structures on agricultural lands even though the land is flooded on an average of once a year. Agricultural use of the flood plain does not restrict high flows and is, therefore, a good use of the flood plain. Low cost flood plain management is the most economical means of reducing and eliminating both losses and the need for further protection. (Knapp-USGS)
W71-02312

NORTHERN IND POWER CO V CASTOR (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD LAND).
For primary bibliographic entry see Field 06E.
W71-02316

COLLINS V GERHARDT (OWNERSHIP OF BEDS OF NAVIGABLE RIVER SUBJECT TO RIGHTS OF NAVIGATION IN PUBLIC).
For primary bibliographic entry see Field 06E.
W71-02317

MORGAN V KLOSS (CONSTRUCTION OF BRIDGE TO ISLAND IN NAVIGABLE LAKE FOR PRIVATE PURPOSES).
For primary bibliographic entry see Field 06E.
W71-02318

FOX RIVER PAPER CO V RAILROAD COMM'N (ACQUISITION OF LICENSE FOR DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-02320

SOUTHERN RY V THACKER (LIABILITY FOR OBSTRUCTING PROPERTY'S NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02321

DAVIS V GULF AND I RY OF TEXAS (SHALLOW AND CROOKED STREAM NOT NAVIGABLE WATERWAY).
For primary bibliographic entry see Field 06E.
W71-02325

WABASH RR V LEWIS (LIABILITY FOR FLOODING CAUSED BY INSUFFICIENT DRAINAGE THROUGH RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-02328

NORFOLK AND W RY V MCCOY (LIABILITY OF RAILROAD FOR RIVERFILL CAUSING OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-02330

KELLY V NAGLE (RIPARIAN RIGHT TO THE NATURAL FLOW OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-02332

CENTRAL OF GEORGIA RY V FAULKNER (LIABILITY FOR CHANGE IN EXISTING DRAINAGE PATTERN).
For primary bibliographic entry see Field 06E.
W71-02337

COVINGTON V CASSIDY BAYOU DRAINAGE DIST (RIPARIAN OWNERS' RIGHT TO, THROUGH A DRAINAGE DISTRICT, PROTECT AGAINST FLOOD BY OBSTRUCTION OF A WATERCOURSE).
For primary bibliographic entry see Field 06E.
W71-02338

SS KRESGE CO V RAILROAD COMM'N (RIGHT TO CONSTRUCT BUILDING ON BED OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02342

CALDWELL V GORE (DUTY OF LOWER ESTATE TO ACCEPT NATURAL DRAINAGE FROM UPPER ESTATE).
For primary bibliographic entry see Field 06E.
W71-02349

ATLANTIC COAST LINE RR V HENDRY (LIABILITY OF RAILROAD FOR FAILURE TO PROVIDE DRAINAGE UNDER TRACKS).
For primary bibliographic entry see Field 06E.
W71-02351

UNITED PAPERBOARD CO V IROQUOIS PULP AND PAPER CO (INTERPRETATION OF DEED WITH RESERVED WATER RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02354

PEOPLE V NEW YORK AND ONTARIO POWER CO (OWNERSHIP OF BEDS OF NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.

W71-02355

PIGEON RIVER IMPROVEMENT, SLIDE AND BOOM CO V CHARLES W COX, LTD (USE AND CONTROL OF STREAMS WHICH FORM AN INTERNATIONAL BOUNDARY).
For primary bibliographic entry see Field 06E.
W71-02357

WYOMING V COLORADO (ENFORCEMENT OF JUDICIAL DECISION SETTING OUT RELATIVE RIGHTS OF ADJOINING STATES TO QUANTITY OF WATER DIVERTED FROM NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-02358

ARKANSAS POWER AND LIGHT CO V ORR (LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT FLOODGATE OPERATION).
For primary bibliographic entry see Field 06E.
W71-02360

PRUYN V NELSON BROS (BATTURE LAND SUBJECT TO PUBLIC SERVITUDE FOR USE IN CONSTRUCTING AND REPAIRING LEVEES).
For primary bibliographic entry see Field 06E.
W71-02362

ARKANSAS POWER AND LIGHT CO V BEAUCHAMP (NEGLIGENCE IN DAM OPERATION AS CAUSE OF FLOODING).
For primary bibliographic entry see Field 06E.
W71-02365

MISSOURI PAC RR V BAKER (LIABILITY FOR FLOOD DAMAGE CAUSED BY CLOGGED CULVERT).
For primary bibliographic entry see Field 06E.
W71-02366

ZOOK V CITY OF LOUISIANA (BLOCKAGE OF DRAIN CAUSED BY CITY'S PAVING OF STREET).
For primary bibliographic entry see Field 06E.
W71-02369

KENTUCKY ELEC DEV CO'S RECEIVER V WELLS (LIABILITY FOR DAMAGE CAUSED BY DAM MAINTAINED AT UNAUTHORIZED HEIGHT DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-02370

TOLER V BEAR CREEK DRAINAGE DIST (AUTHORITY OF DRAINAGE DISTRICT TO DIVERT WATER FROM WATERSHED).
For primary bibliographic entry see Field 06E.
W71-02371

DALY V STATE (NO OBLIGATION RESTS ON STATE TO PROTECT LANDS THAT WOULD BE FLOODED EVEN IN ABSENCE OF STATE-CONSTRUCTED CANAL).
For primary bibliographic entry see Field 06E.
W71-02376

HAYS V HOFFMAN (OBSTRUCTION OF DRAINAGE DITCH ALLEGED TO HAVE CAUSED OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-02380

TAYLOR V LEXINGTON WATER POWER CO (NEGLIGENT RELEASE OF FLOODWATERS FROM DAM).
For primary bibliographic entry see Field 06E.
W71-02381

FAIREY V SOUTHERN RY (RAILROAD EMBANKMENT ALLEGED TO HAVE DAMMED SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02382

BYRD V PENNSYLVANIA RR (OVERFLOW DAMAGE CAUSED BY PLUGGED RAILROAD CULVERT AFTER HEAVY RAINFALL).
For primary bibliographic entry see Field 06E.
W71-02383

HUGGINS V ATLANTIC COAST LINE RR (RAILROAD FILL ALLEGED TO HAVE CAUSED FLOODWATER DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02385

LEITCH V CITY OF CHICAGO (FEDERAL JURISDICTION OF CASES INVOLVING NAVIGABLE STREAMS).
For primary bibliographic entry see Field 06E.
W71-02387

WASHBURN V CAMPBELL (PAROL PERMISSION AS MERE LICENSE TO MAINTAIN DAM).
For primary bibliographic entry see Field 06E.
W71-02389

HUNTER V CLEVELAND, C C AND ST L RY (COLLECTION AND DISCHARGE OF WATER IN VOLUME PROHIBITED).
For primary bibliographic entry see Field 06E.
W71-02390

CASHIN V CITY OF NEW ROCHELLE (DAMAGES FROM OVERFLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02391

BEAN V CENTRAL MAINE POWER CO (APPROPRIATION OF WATER CURRENT).
For primary bibliographic entry see Field 06E.
W71-02392

BALDWIN V NEAL (LIABILITY FOR OBSTRUCTION OF STREAM FLOW BY INADEQUATE PASSAGEWAYS UNDER RAILROAD BRIDGE).
For primary bibliographic entry see Field 06E.
W71-02394

LEISL V CITY OF NEWPORT (LIABILITY FOR OVERFLOW RESULTING FROM INADEQUACY OF CULVERT).
For primary bibliographic entry see Field 06E.
W71-02395

FORKNER V CHESAPEAKE AND O RY (RESTORATION OF NATURAL DRAINAGE COURSE BY CULVERT).
For primary bibliographic entry see Field 06E.
W71-02396

FRANK V DIERSON (LIABILITY FOR ALTERATION OF NATURAL DRAINAGE DIRECTION).
For primary bibliographic entry see Field 06E.
W71-02398

WALTER V WAGNER (FLOOD DAMAGE CAUSED BY LANDFILL).
For primary bibliographic entry see Field 06E.
W71-02399

KIGER V SANKO (DAMAGE CAUSED BY EXCESSIVE SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W71-02400

ROSITZKY V BURNES (FLOOD DAMAGE TO ADJACENT BUILDING CAUSED BY OVERFLOW FROM ROOF).
For primary bibliographic entry see Field 06E.
W71-02401

YOUNG V ILLINOIS CENT RR (RAILROAD EMBANKMENT ALLEGED TO HAVE OBSTRUCTED NATURAL DRAINAGE, CAUSING FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02402

CALDWELL V GORE (INTERSTATE SURFACE RUNOFF: LOWER SERVITUDE).
For primary bibliographic entry see Field 06E.
W71-02403

MEYERS V BEAUCHAMP (RIGHT OF RIPARIAN OWNER TO PROTECT HIS LAND).
For primary bibliographic entry see Field 06E.
W71-02405

HUTCHINGS V WABASH RY (UPSTREAM OWNER'S DIVERSION OF WATERCOURSE).

33 SW2d 147-149 (Mo 1930).

Descriptors: *Missouri, *Diversion, *Obstruction to flow, *Erosion, Legal aspects, Judicial decisions, Flow, Rivers, Real property, Land, Railroads, Bridges, Streams, Streamflow, Bank erosion, Stream erosion, Damages, Bank stability, Riparian rights, Relative rights, Reasonable use, Embankments.
Identifiers: Revetment.

Defendant railroad constructed a trestle and bridge across a river. When the force of the river current began to wear away the railroad right-of-way, defendant constructed a rock revetment. The water struck the revetment and was diverted with such force that the river channel was altered, eroding plaintiff's property below the bridge. Plaintiff sought damages for permanent injury to his property, contending that defendant was collecting water upstream of the bridge and causing it to discharge onto his property. The Kansas City Court of Appeals affirmed a judgment for defendant, stating that defendant was within its rights in preventing erosion of its property. Plaintiff's loss was merely incidental to defendant's exercise of its right. There was no showing of negligence in defendant's construction of the embankment. (Dye-Florida)
W71-02406

HARTZELL V VILLAGE OF HAMBURG (VILLAGE BOUND TO ACQUIRE WATER SUPPLY FOR PUBLIC USE BY CONDEMNATION OR GRANT).
For primary bibliographic entry see Field 06E.
W71-02410

BUSH V CITY OF ROCHESTER (LIABILITY FOR EXPULSION OF SURFACE WATERS UPON LAND OF ANOTHER BY CONSTRUCTION OF A ROAD).
For primary bibliographic entry see Field 06E.
W71-02412

FENNEMA V NOLIN (CONSTRUCTION OF DITCH JUSTIFIED WHERE DISCHARGE OF WATER WAS ABOUT SAME AS UNDER THE NATURAL COURSE OF SAID DITCH).
For primary bibliographic entry see Field 06E.
W71-02413

BEECHLEY V HARMS (INJUNCTION AGAINST INTERFERENCE WITH NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02416

ALLIANCE MILLS CO V SOCIETY FOR ESTABLISHING USEFUL MANUFACTURES (GRANTS OF FLOWAGE RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02418

MAYLENDER V FULTON COUNTY GAS AND ELEC CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W71-02420

LOWE V INDIANA HYDROELECTRIC POWER CO (CONDEMNATION POWER OF ELECTRIC UTILITY).
For primary bibliographic entry see Field 06E.
W71-02421

KLEINBERG V RATETT (CONDUIT CARRYING NATURAL STREAM UNDER PROPERTY DOES NOT CONSTITUTE ENCUMBRANCE AGAINST TITLE).
For primary bibliographic entry see Field 06E.
W71-02423

POTAMOLOGY DATA COLLECTION ON LOWER MISSISSIPPI RIVER,
Army Engineer District, Vicksburg, Miss. River Stabilization Branch.
For primary bibliographic entry see Field 02E.
W71-02438

FLOOD PLAIN INFORMATION, FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, BLACK RIVER, OHIO.
Corps of Engineers, Buffalo, N.Y.

Corps of Engineers Flood Plain Report, May 1970. 9 p, 6 fig, 12 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Historic flood, Flood plains, Ohio, Flood control, Nonstructural alternatives, Flood protection.
Identifiers: Black River (Ohio), Flood-hazard report.

This flood hazard report presents information specifically for the historical July 1969 flood, including the flooded area map and water surface profiles. Precipitation gages in the Black River watershed show that more than 4 in of rain fell in a 24-hr period with an average intensity of 0.17 in per hr, an occurence interval of once in 50 yr. The USGS water stage recorder below the confluence of East and West branches of the river was washed away, having been in operation since 1944. Industrial plants and Elyria City were damaged by high water and debris. Major floods have occurred along this river in the following decreasing order of magnitude: March 1913, January 1959, May 1956, February 1959, and June 1937. Maps, profiles, photographs and other data are given which will be beneficial for planning and development by State and local governments. (Lang-USGS)
W71-02447

FLOOD PLAIN INFORMATION, DESTIN COASTAL AREA, OKALOOSA COUNTY, FLORIDA.
Corps of Engineers, Mobile, Ala.

Corps of Engineers Flood Plain Report, June 1970. 19 p, 4 fig, 9 plate, 1 tab.

Descriptors: *Hurricanes, *Flooding, *Tidal waters, *Wind tides, Flood damage, Beaches, Gulf of Mexico, Florida, Historic flood, Flood forecasting.
Identifiers: *Flood tides, Intermediate regional flood.

Tidal flooding along the northern coast of the Gulf of Mexico near Destin, Florida is described to aid local agencies with factual bases for reducing future damages and hazards through planning better utilization of areas subject to flooding. Basic data used in preparation of the report include historical flood heights, hurricane pressure, radius and speed, tide records, and flood damage records. The greatest known flood tide at Destin occurred during the hurricane of September 20, 1926 and was 10 to 12 ft above msl on the beach. Other hurricanes causing lesser flood tides occurred in September 1906, July 1936, August 1950, and September 1956. Maximum winds range from 75 to over 200 mph (the strongest was during Camille in August 1969). The 1926 hurricane at Destin had winds up to about 150 mph. (Lang-USGS)
W71-02453

FLOOD PLAIN INFORMATION, YAKIMA-UNION GAP, WASHINGTON.
Corps of Engineers, Seattle, Wash.

Corps of Engineers Flood Plain Report, May 1970. 57 p, 22 fig, 17 plate, 15 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Regional flood, Flood forecasting, Flood control, Historic flood.
Identifiers: *Flood records, *Yakima River, Naches River, Stnadard project flood, Intermediate regional flood.

Flooding along the Yakima and Naches Rivers near the cities of Yakima and Union Gap, Washington is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall runoff, historical flood heights and other technical data. The December 1933 flood is the largest known on Yakima River and had a peak stage of 15 ft at Parker. An intermediate regional flood has a 1% chance of being equalled or exceeded annually, and maximum flow would be about 70,000 cfs at Parker, while the standard project flood has a peak discharge of 180,000 cfs in the Yakima reach studied. Water velocities vary widely at different places on the floodplain, and flood duration may be for a month. (Woodard-USGS)
W71-02456

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, SEMINOLE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.

Corps of Engineers Flood Plain Report, September 1970. 31 p, 7 fig, 9 plate, 6 tab.

Descriptors: *Floods, *Flood damage, *Florida, Flood plains, Regional flood, Flood forecasting, Flood control, Hurricane.
Identifiers: *Seminole County (Fla), Standard project flood, Intermediate regional flood.

Flooding along Little Wekiva River in western Seminole County, Florida is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Velocities of water during the Intermediate Regional Flood would range up to 7.3 feet per second (5 miles per hour) in the channel of Little Wekiva River. During the Standard Project Flood channel velocities of up to 7.8 feet per second can be expected. Velocities in the flood plain for both Intermediate Regional and Standard Project Floods would vary widely, but would generally be less than 2.2 feet per second. The scheduled construction of the new culverts at S.R. 436 will increase velocities in the channel by 0.7 foot per second and in the flood plain by 0.2 foot per second. Velocities greater than 3 feet per second combined with depths of 3 feet or more are generally considered hazardous. (Woodard-USGS)
W71-02457

LOCATING AND TRACING SEEPAGE WATER IN UNSTABLE SLOPES,
Kentucky Dept. of Highways, Lexington. Div. of Research.
Y. A. Alkhoja, and G. D. Scott.
Final Report, February 20, 1970. 37 p. HPR - Kyhpr 63-16.

Descriptors: *Seepage, *Tracers, *Groundwater, *Locating, Slope Stability, Landfills, Fluorescence, Ultraviolet Radiation, Water table, Resistivity, Moisture content, Drilling, Percolation, Dye releases.

A practical method of locating and tracing seepage water in unstable slopes is needed. The study consisted of testing several methods at sidehill fill locations where the highway was distressed. In each case, construction of the fill had blocked drainage. The results of the study indicate the following: (1) Clean, fine sand did not remove fluorescent dye from solution for moderate percolation distances, but the dye became somewhat less detectable due to its absorption by the sand for longer percolation distances. The conventional monitoring equipment (ultraviolet light) was not sufficiently efficient to monitor low concentrations of the dye. The tracer method was not dependable for the purpose of locating seepage waters and was shown to require further improvement. However, it was used to verify a suspected source of seepage when the ground water was believed to have traveled through defined channels or very porous material, (2) The water table observation method was the most definitive and useful of the methods studied for tracing and locating seepage water, (3) The electrical resistivity method did not yield very accurate and dependable results without correlation with actual site moisture conditions, and (4) With more and better selection of sampling holes and resistivity observations, more useful results could be obtained from this method. Since the resistivity results show fair correlations with actual moisture conditions, it is concluded that this method could be used as a preliminary guide as to where drilling should be performed, and possibly to extend relative moisture content data to areas inaccessible to drilling equipment.
W71-02522

PERFORMANCE OF AN ASPHALT TREATED DRAINAGE BLANKET IN A FLEXIBLE PAVEMENT SECTION,
California State Div. of Highways, Sacramento.
T. Smith, R. Forsyth, and W. Gray.
Interim Report M and R No 632618, December 1969. 37 p. 4830213 70.

Descriptors: *Subsurface drainage, *Drainage systems, *Asphalt, *Roads, Filters, Stabilization, Highways.
Identifiers: *Drainage blankets.

Results are presented of a field evaluation of a two-layer highway drainage system on Road 299 between Arcata and Willow Creek in the Northern Coastal Region of California. The experimental section consisted of 400 feet utilizing a two-layer drainage blanket, the top, or drainage element, which was stabilized with asphalt, and 200 feet of normal single-layer drainage blanket serving as a control. The section was located in a cut section with numerous springs and seeps in a high rainfall areas Data from field permeability tests indicated that the drainage capacity of the two-layer system was 3 to 9 times that of the standard underdrain section, while theory indicated a 24 to 1 ratio. Through an unusually wet winter and spring, both sections effectively drained all subsurface water at

the site. Only minor difficulties were encountered in the construction of the two-layer system which could probably have been eliminated by a modification in the grading of the filter element.
W71-02523

STUDY OF EROSION IN ROADSIDE DRAINAGE CHANNELS IN NORTH CAROLINA,
North Carolina State Univ., Raleigh. School of Engineering.
Michael Amein, and H. L. Chu.
Final Report ERD-110-68-4, Appendix, September 1969. 63 p.

Descriptors: *Erosion control, *Roads, *Drainage systems, Design, Channels, *Soil erosion, *Surface drainage, Highways.
Identifiers: *Roadside.

An extensive field study of the performance of roadside drainage channels in North Carolina against the action of erosive forces was conducted. From the results of field observations and measurements, a criteria for the design of stable roadside channels was developed. The report presents three methods of determining whether a triangular shaped roadside drainage channel will be stable if it is fully grassed, partially grassed or bare earth when the discharge to be carried, the slope of the channel bottom, the side slope of the channel, and the soil characteristics of the channel are known. (See also W70-09455)
W71-02525

WINCHESTER V BYERS (LIABILITY FOR ALTERING NATURAL FLOW OF SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02527

MARKLE V GROTHE (COLLECTION AND DISCHARGE OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-02529

DICKINSON V NEW ENGLAND POWER CO (RELATIVE RIGHTS OF DAM OWNER AND LANDOWNER).
For primary bibliographic entry see Field 06E.
W71-02530

TERRITORY OF HAWAII V GAY (RIGHT TO DIVERT WATERS BY OWNER OF LAND AT RIVER'S SOURCE).
For primary bibliographic entry see Field 06E.
W71-02535

UNITED STATES V TUJUNGA WATER AND POWER CO (FORFEITURE OF RIGHTS TO PUBLIC LANDS BY FAILURE TO MEET CONDITIONS OF A GRANT).
For primary bibliographic entry see Field 06E.
W71-02536

CITY OF GOLD HILL V CALIFORNIA-OREGON POWER CO (ACQUISITION OF PRESCRIPTIVE RIGHT TO CONSTRUCT DAM).
For primary bibliographic entry see Field 06E.
W71-02538

WRIGHT V CITY OF RICHMOND (CITY'S LIABILITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
For primary bibliographic entry see Field 06E.
W71-02540

CITY OF PORTSMOUTH V WEISS CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM WASHOUT).
For primary bibliographic entry see Field 06E.
W71-02542

HARRIS MOTOR CO V PULASKI FURNITURE CO (LIABILITY FOR DAMAGE CAUSED BY REPULSION OF SURFACE WATER BY CONSTRUCTION OF BUILDING).
For primary bibliographic entry see Field 06E.
W71-02543

RHINES V COMMISSIONERS OF CHATHAM COUNTY (COUNTY'S LIABILITY FOR OVERFLOWING LAND).
For primary bibliographic entry see Field 06E.
W71-02546

WHITTINGTON V CITY OF BEDFORD (LIABILITY FOR FLOOD DAMAGES CAUSED BY DAM CONSTRUCTION),
For primary bibliographic entry see Field 06E.
W71-02547

LYNCH V MINNESOTA POWER AND LIGHT CO (MEASURE OF DAMAGES FOR FLOOD INJURY TO FARMLAND).
For primary bibliographic entry see Field 06E.
W71-02549

HENRY V CHICAGO, B AND O RR (PROXIMATE CAUSE OF FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02553

BOARD OF ROAD COMM'RS V MARKLEY (LIABILITY FOR DAMAGES FROM NEGLIGENT DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W71-02556

WILLIE V MINNESOTA POWER AND LIGHT CO (LIABILITY FOR FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).

250 NW 809-812 (Minn 1933).

Descriptors: *Minnesota, *Flood damage, *Remedies, Operation and maintenance, Floods, Flooding, Dam design, Excessive precipitation, Reservoirs, Operations, Damages, Water injury, Crops, Adjudication procedure, Judicial decisions, Legal aspects, Floodgates.

Plaintiff landowner brought an action to recover for damages done to his crops caused by defendant power company's negligent operation of a dam. Following an extremely heavy rainfall, the dam developed severe breaks, and it became necessary to open the floodgate while repairs were made, thus allowing the impounded water to flow from the reservoir and flood plaintiff's land. Defendant argued that the allegations were insufficient to establish a case of negligence. The Supreme Court of Minnesota, affirming a judgment for plaintiff, ruled that either of two theories of negligence would be sufficient to have such a case determined by a jury: (1) the doctrine of res ipsa loguitur, and (2) the theory that while an owner of a dam is not an insuror of its safety, he still must exercise care commensurate with any danger which might reasonable stem from the operation of the dam. (Barker-Florida)
W71-02558

COLUMBUS AND GREENVILLE RY V TAYLOR (RIGHT OF RAILROAD TO OBSTRUCT SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02560

KILLGORE V COLE (LIABILITY FOR OBSTRUCTION TO FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02563

CITY OF MOBILE V LARTIGUE (SERVIENT LAND MUST ACCEPT ONLY WATER FLOWING NATURALLY THERETO FROM DOMINENT ESTATE).
For primary bibliographic entry see Field 06E.
W71-02564

LAW V GULF STATES STEEL CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW OF EXCESS WATER IN STREAM).
For primary bibliographic entry see Field 06E.
W71-02568

CRESSON V LOUISVILLE AND N RR (LIABILITY FOR COLLECTION AND DISCHARGE OF DRAINAGE WATER IN EXCESSIVE VOLUME).
For primary bibliographic entry see Field 06E.
W71-02571

SEABOARD ALL FLORIDA RY V UNDERHILL (INJUNCTIVE RELIEF FOR FLOODING BY OBSTRUCTION OF NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02572

BOLINGER V MURRAY (LIABILITY FOR LEVEE WHICH OBSTRUCTED NATURAL FLOW).
For primary bibliographic entry see Field 06E.
W71-02573

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY FOR MAINTAINING FLASHBOARDS FOR PRIVATE BENEFIT ON A FEDERAL DAM).
For primary bibliographic entry see Field 06E.
W71-02581

CLEVELAND, C C AND ST L RY V MUMFORD (CONSTRUCTION OF LEVEES).
For primary bibliographic entry see Field 06E.
W71-02592

LOUISVILLE AND N RR V O'FLYNN (LIABILITY FOR CROP DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCHES).
For primary bibliographic entry see Field 06E.
W71-02597

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: STORM WATER RUNOFF AND DRAINAGE FACILITIES.
Mercer County Planning Board, Trenton, N.J.

Available from Ntis as PB-193 993, $3.00 in paper copy, $0.95 in microfiche. Final Report No 6, September 1969. 30 p, 5 tab, 10 ref. HUD Project NJ P-96.
Identifiers: *Regional planning, *New Jersey, *Drainage, Regional planning, *Runoff, Rainfall, Culverts, Bridges (Structures), Surveys, Factor analysis, Statistical data, Storm drainage, Storm water, *Mercer County (NJ).

Major problems occur in developing areas when open land which formerly absorbed rain water becomes covered with structures and asphalt. The county has a major responsibility in ensuring that, as land becomes developed and storm water runoffs increase, facilities guiding flows under county roads remain adequate to handle the increased water flow. The report analyzes each of the drainage areas adjacent to existing major county bridges or culverts to determine whether they will be adequate to handle increased flows when the drainage areas develop as presently zoned.
W71-02602

OPPORTUNITIES AND RESPONSIBILITIES OF LOCAL GOVERNMENT,
Urban Renewal Board, Waterloo, Iowa.
For primary bibliographic entry see Field 06F.
W71-02650

OPEN SPACE PROGRAM OPPORTUNITY IN LAND MANAGEMENT,
National Capital Park and Planning Commission, Washington, D.C.
For primary bibliographic entry see Field 06F.
W71-02656

COMPREHENSIVE FLOOD PLAIN DEVELOPMENT WITH TVA,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 06F.
W71-02657

SCS PROGRAMS IN URBAN AND RURAL DEVELOPMENT,
Soil Conservation Service, Beltsville, Md.
For primary bibliographic entry see Field 06F.
W71-02663

PEARCE V SCOTT (OBSTRUCTION OF NATURAL FLOW OF DRAINAGE FROM DOMINANT LAND).
For primary bibliographic entry see Field 06E.
W71-02684

4B. Groundwater Management

THE STUDY OF COLLECTOR WELLS BY MEANS OF VISCOUS FLOW ANALOGY,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
For primary bibliographic entry see Field 08B.
W71-02266

COMBATTING SALT-WATER ENCROACHMENT INTO THE BISCAYE AQUIFER--MIAMI, FLORIDA AREA,
Dade County Public Works Department, Miami, Florida.
F. D. Ronald Park.
Presented at Ltd Professional Symposium on Salt Water Encroachment Into Aquifers, May 4-5, 1967, Louisiana State University. Copies of report available from LSU Bookstore, $5.00. In: 'Salt Water Encroachment Into Aquifers', Bulletin 3, Louisana Water Resources Research Institute, Louisiana State University, Baton Rouge, October 1968. 73 p, 27 fig, 2 tab, 16 ref.

Descriptors: *Encroachment, *Aquifers, *Water quality, *Groundwater, *Water management, *Water supply, Dams, Canal seepage, Leakage, Fresh water, Potable water, Florida.
Identifiers: *Miami (Florida).

The fresh water supply serving the people of the Miami, Florida area is pumped from the Biscayne Aquifer which covers about 3,000 square miles of Dade and Broward Counties and penetrates about 40 miles inland from the Atlantic Ocean and Biscayne Bay. The aquifer is wedge-shaped in elevation, with the base averaging 100 feet below sea level along the coast and rising gradually to zero elevation at its western extremity. The aquifer leaks along its sides. Subsequent to the drainage of the Everglades in 1904, salt water has encroached as far inland as six miles. Programs of Dade County, the Central and Southern Florida Flood Control District, and the U. S. Corps of Engineers have generally stabilized the salt front. Dams are employed in the area's canals to prevent salt water encroachment; however, where the dams are located far inland, to facilitate navigation, encroachment continues. Dams are of two main types: (1) steel piling cut-offs, with removal sections for facilitating large outflows; and (2) automatic vertical-lift gates. The paper describes the problems encountered and the measures implemented in Dade County's 20-year program of combatting salt water encroachment. Legal questions and the effects of the program on water supply, pollution, navigation, land use, subdivision development and people are discussed. (Poertner)
W71-02283

WILLARD V STONE (EASEMENT FOR WATER SUPPLY MEANS REASONABLE USE OF ALL WATER ON SERVIENT PROPERTY).
For primary bibliographic entry see Field 06E.
W71-02329

DAVISON V CITY OF ANN ARBOR (FAILURE OF PROOF THAT LOWERING OF WATER TABLE WAS DUE TO OTHER THAN NATURAL CAUSES).
For primary bibliographic entry see Field 06E.
W71-02378

DEEP WELL DISPOSAL STUDY FOR BALDWIN, ESCAMBIA AND MOBILE COUNTIES, ALABAMA,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 05E.
W71-02428

HYDRAULIC TESTS IN HOLE UA-1 AND WATER INFLOW INTO AN UNDERGROUND CHAMBER, AMCHITKA ISLAND, ALASKA,
Geological Survey, Denver, Colo.
Wilbur C. Ballance.
Geological Survey Open-file Report (Ref Amchitka-21, USGS-474-72), October 1970. 54 p, 37 fig, 1 tab, 4 ref. USAEC Contract AT (29-2)-474.

Descriptors: *Groundwater movement, *Hydraulic gradient, *Drill holes, *Inflow, Aquifers, Mining, Injection wells, Equations, Test procedures, Water levels, Transmissivity, Hydraulic conductivity, Velocity, Storage capacity.
Identifiers: *Underground chamber, Swabbing recovery test.

Hole UA-1, Amchitka Island, was center punched from 1,524.0 to 1,981.2 meters and hydraulically tested to determine an ideal location for mining a chamber. Fifteen zones were tested. Minor amounts of water bypassed the packers during five of the tests. The tested intervals ranged in length from 37.5 to 211.5 meters. For purposes of comparison, relative specific capacities were calculated from comparable 60.4-meter intervals of tested rock, and ranged from 0.1162 to 0.0039 cubic meters per day per meter of drawdown. The interval, 1,745.0 to 1,836.4 meters, appears to be the best location for mining a chamber so far as water inflow is concerned. This interval, 91.4 meters, consists of about 27.4 meters of breccia and 64.0 meters of basalt. The inflow to a spherical chamber 18.3 meters in diameter placed in the center of the proposed 91.4-meter interval, was calculated to be about 175 cubic meters per day after the first day and would stabilize at about 57 cubic meters per day after about 200 days. (Woodard-USGS)
W71-02429

THE ROCK AND BONG TECHNIQUES OF MEASURING WATER LEVELS IN WELLS,
Missouri Univ., Rolla. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 07B.
W71-02445

SOME LIMITATIONS OF SEISMIC REFRACTION METHODS IN GEOHYDROLOGICAL SURVEYS OF DEEP ALLUVIAL BASINS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02F.
W71-02446

FACTORS CONTRIBUTING TO UNUSUALLY LOW RUNOFF DURING THE PERIOD 1962-68 IN THE CONCHO RIVER BASIN, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W71-02448

GROUNDWATER AVAILABILITY IN FORD COUNTY,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02F.
W71-02449

GEOLOGY AND GROUNDWATER RESOURCES OF LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02F.
W71-02450

DIGITAL SIMULATION OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, KANSAS,
Kansas State Geological Survey, Colby.
For primary bibliographic entry see Field 02F.
W71-02454

GROUNDWATER IN MONTANA,
Montana Bureau of Mines and Geology, Butte.
For primary bibliographic entry see Field 02F.
W71-02468

4C. Effects on Water of Man's Non-Water Activities

A MODEL RELATING WATER QUALITY VEGETATIONAL STRUCTURE AND URBANIZATION IN THE SAN JACINTO RIVER BASIN,
Houston Univ., Tex. Dept. of Biology.
For primary bibliographic entry see Field 05G.
W71-02271

SOUTHERN RY V THACKER (LIABILITY FOR OBSTRUCTING PROPERTY'S NATURAL DRAINAGE).
For primary bibliographic entry see Field 06E.
W71-02321

HUMPHRIES V BLACK BETSEY CONSOL COAL CO (LIABILITY FOR FLOOD DAMAGES DUE TO DIVERSION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02322

DAVIS V GULF AND I RY OF TEXAS (SHALLOW AND CROOKED STREAM NOT NAVIGABLE WATERWAY).
For primary bibliographic entry see Field 06E.
W71-02325

OZARK PIPE LINE CORP V DECKER (LIABILITY FOR STREAM CONTAMINATION BY OIL).
For primary bibliographic entry see Field 06E.
W71-02326

WABASH RR V LEWIS (LIABILITY FOR FLOODING CAUSED BY INSUFFICIENT DRAINAGE THROUGH RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-02328

NORFOLK AND W RY V MCCOY (LIABILITY OF RAILROAD FOR RIVERFILL CAUSING OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-02330

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (OWNER OF BANK OWNS TO THREAD OF CHANNEL).
For primary bibliographic entry see Field 06E.
W71-02331

CENTRAL OF GEORGIA RY V FAULKNER (LIABILITY FOR CHANGE IN EXISTING DRAINAGE PATTERN).
For primary bibliographic entry see Field 06E.
W71-02337

VAN CORTLANDT V NEW YORK CENT RR (PRIVATE RIGHT TO RELIEF FROM PUBLIC NUISANCE).
For primary bibliographic entry see Field 06E.
W71-02343

FREED V MIAMI BEACH PIER CORP (INFRINGEMENT OF OCEANFRONT RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02344

ATLANTIC COAST LINE RR V HENDRY (LIABILITY OF RAILROAD FOR FAILURE TO PROVIDE DRAINAGE UNDER TRACKS).
For primary bibliographic entry see Field 06E.
W71-02351

THE KARD (DAMAGES TO BARGE CAUSED BY RAILROAD'S DRAWBRIDGE OVER NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-02352

VAN CORTLANDT V NEW YORK CENT RR (BRIDGE OBSTRUCTING NAVIGABLE STREAM NOT ENJOINED WHERE NO DAMAGE SHOWN).
For primary bibliographic entry see Field 06E.
W71-02356

KENTUCKY ELEC DEV CO'S RECEIVER V WELLS (LIABILITY FOR DAMAGE CAUSED BY DAM MAINTAINED AT UNAUTHORIZED HEIGHT DURING UNPRECEDENTED FLOOD).
For primary bibliographic entry see Field 06E.
W71-02370

FORKNER V CHESAPEAKE AND O RY (RESTORATION OF NATURAL DRAINAGE COURSE BY CULVERT).
For primary bibliographic entry see Field 06E.
W71-02396

REUGSEGGER V CHIGAGO GREAT WESTERN RR (LIABILITY FOR FLOODING CAUSED BY OBSTRUCTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-02397

YOUNG V ILLINOIS CENT RR (RAILROAD EMBANKMENT ALLEGED TO HAVE OBSTRUCTED NATURAL DRAINAGE, CAUSING FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-02402

HUTCHINGS V WABASH RY (UPSTREAM OWNER'S DIVERSION OF WATERCOURSE).
For primary bibliographic entry see Field 04A.
W71-02406

CARETTI V BRORING BLDG CO (LIABILITY FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02424

STREAM SEDIMENT: AN ENVIRONMENTAL PROBLEM,
Geological Survey, Fort Collins, Colo.
Harold P. Guy, and George E. Ferguson.
Journal of Soil and Water Conservation, Vol 25, No 6, p 217-221, November-December 1970. 5 p, 2 fig, 3 tab, 19 ref.

Descriptors: *Sedimentation, *Erosion, *Urbanization, *Erosion control, Storm runoff, Accelerated erosion, Soil erosion, Sediment yield, Provenance, Land use, Floods, Land management.
Identifiers: *Urban erosion, *Construction-site erosion.

Urban erosion involves construction sites that tend to be widely dispersed. Unlike the continuing erosion on poorly managed agricultural lands, construction sites erode mainly during the brief periods between land clearing and stabilization of the new surface. In Scott Run, a 4.54-square-mile watershed near Washington, D.C., highway construction affected about 11% of the watershed from 1961 to 1964. Measurements of 88 storm events showed that 37% of the runoff and 99% of the sediment movement occurred in 3% of the time, and that highway construction areas, 1 to 10% of the basin, contributed 85% of the sediment. Erosion was about 10 times that normally expected from cultivated land, 200 times that expected from grassland and 2,000 times that expected from forest land. Sediment transport in storm runoff was measured for 25 storm events from a 58-acre watershed in Kensington, Md., between July 1959 and January 1962. During this period, 89 single-dwelling houses were constructed on 20 1/2 acres in the upper part of the watershed. An average of 189 tons of sediment per acre was lost from the area. (Knapp-USGS)
W71-02443

EFFECTS OF LAND MANAGEMENT ON QUANTITY AND QUALITY OF AVAILABLE WATER,
New South Wales Univ., Kensington (Australia). Water Research Lab.
Walter C. Boughton.
Australian Water Resources Council Research Report No 120, May 1970. 330 p, 1092 ref. AWRC Project 68/2.

Descriptors: *Land management, *Impaired water quality, *Bibliographies, *Reviews, Erosion, Groundwater movement, Watersheds (Basins), Soil management, Saturated soils, Floods, Water supply, Publications, Runoff, Land use, Vegetation effects, Forecasts.
Identifiers: *Australia, Annotated bibliography, Literature evaluation, Catchment management.

This report results from a project recommended by the Australian Water Resources Council to compile the important sources of water information with emphasis on Australian work but also to search overseas literature largely on principles and methodologies. A centralization of water information is needed for use by authorities in catchment basin management, and is prerequisite for future experimental studies and research. To fulfill the major objectives, an annotated bibliography and a critical evaluation of the literature and current knowledge is presented in this report. A major change that has occurred since settlement of Australia by Europeans is that large areas of native bush have been cleared for pasture or crops with quite apparent effects on the hydrologic cycle. Little precise knowledge is available, but an increase has been noted in total runoff in some stream basins, and the change from trees to grasses and crops has resulted in raising of saline groundwater levels at the foot of slopes and in valleys. Subsequent salting of large areas is evident as water evaporates from the shallow groundwater bodies. Increased erosion has occurred and turbidity levels in streams have risen. The report cites work in progress and needed investigations. Contains 1,092 references distributed under 11 subject chapters. (Lang-USGS)
W71-02452

CANE CREEK COAL MINING CO V BRADEN (DAMAGES CAUSED BY COAL COMPANY'S IMPEDING FLOW OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02686

4D. Watershed Protection

URBAN SOIL EROSION AND SEDIMENT CONTROL,
National Association of Counties Research Foundation, Washington, D.C.
Mel D. Powell, William C. Winter, and William P. Bodwitch.
Available from the NTIS as PB-196 111, $0.95 in microfiche. For sale by the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402. Price $1.00, Order no I67.13/4:1503 DTL05. Water Pollution Control Research Series 15030 DTL, May 1970. 97 p. FWQA Program 15030 DTL.

Descriptors: Sedimentation, *Soil erosion, *Sediment control, Urban runoff, Watershed management, *Drainage control, *Reviews, *Urbanization, Soil conservation, Legislation, Social aspects, Legal aspects, Water pollution control, Governments, Water law.
Identifiers: *Urban sediment control.

This study was conducted to determine the causes and the extent of urban and suburban soil erosion and sediment problems, and to describe ways in which local communities can organize and implement effective sedimentation control programs. An evaluation is provided on the state-of-the-art of urban sedimentation control, and a series of research needs in the sedimentation field is cited. In addition, this report includes the 'Community Action Guidebook for Soil Erosion and Sediment Control' (See also W70-06574) which describes methods by which local governments can organize, plan, finance, staff, and implement urban sedimentation control programs. Aspects of areawide approaches, legal authority, and public support for sedimentation control are discussed, and an action plan is outlined. It was found that soil erosion and sediment in developing areas is extensive, and that these problems pose significant threats to both soil and water resources. While many of the required technical means for controlling sedimentation problems already exist, new administrative approaches are needed which accomodate the diversity of interests and pressures associated with urban and suburban development. (Winter-NACRF)
W71-02276

TOLER V BEAR CREEK DRAINAGE DIST (AUTHORITY OF DRAINAGE DISTRICT TO DIVERT WATER FROM WATERSHED).
For primary bibliographic entry see Field 06E.
W71-02371

PROCEEDINGS OF THE NATIONAL CONFERENCE ON SEDIMENT CONTROL.
Dept. of Housing and Urban Development, Washington, D.C. Office of Metropolitan Planning and Development.

Proceedings of National Conference on Sediment Control, U.S. Dept. of Housing and Urban Development, Environmental Planning Paper, May 1970. 54 p.

Descriptors: *Sedimentation, *Urbanization, *Cities, *Erosion, Deposition (Sediments), Silting, Legislation, Legal aspects, Regulation, Water pollution sources, Water quality control, Conferences, Reviews.
Identifiers: *Urban sediment control.

The National Conference on Sediment Control was convened in Washington, D.C. on September 14-16, 1969. The purpose was to bring together representatives of state, regional and local agencies to explore ways of combating soil erosion and sedi-

ment problems in urban and suburban areas. A major task of the conference was the development of a final version of a 'Community Action Guidebook for Soil Erosion and Sediment Control'. It is estimated that more than 4,000 acres a day are being plowed up to build real estate developments, suburban facilities, highways and industries. Sediment yields from some of these activities are believed to be 500 times greater than from rural soil erosion, and urban drainage from concrete surfaces provides another substantial source of sediment deposits. Nine papers are printed in the proceedings; they describe pertinent policies and programs aimed at efforts by Federal, State and local officials to obtain more effective sediment controls in urban and suburban areas. (Knapp-USGS)
W71-02425

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

WATER GEOCHEMISTRY, HOG CREEK BASIN, CENTRAL TEXAS,
Baylor Univ., Waco, Tex. Dept. of Geology.
Thomas H. Moore.
Available from Dept of Geology, Baylor Univ, Waco, Tex 76703 - Price $1.04. Baylor Geological Studies Bulletin No 18, Baylor University, Spring 1970. 44 p, 52 fig, 1 tab, 35 ref, 3 append.

Descriptors: *Water chemistry, *Hydrologic cycle, *Hydrogeology, *Chemical analysis, *Texas, Geologic investigations, Rainfall, Runoff, Streamflow, Drainage, Infiltration, Groundwater movement, Aquifer characteristics, Spring waters, Geochemistry, Climatic data, Land use, Fertilizers, Soil-water-plant relationships.
Identifiers: Central Texas, Hurst Spring.

This report describes water quality changes in the upper part of Hog Creek basin (48.6 sq mi area), Central Texas, from the time of rainfall on the headwaters until the streamflow reaches Farm Road 217, about 19 mi downstream. Temperature, pH, and dissolved oxygen were measured in the field at 5 sites and various chemical tests were made in the laboratory. Except for brief periods of storm runoff, the creek flow is from springs, principally Hurst Spring. Analyses were made of water samples from each of the major rock formations. The Edwards Limestone, a shallow aquifer, is subject to pollution from agricultural fertilizers as was disclosed by unusually high nitrate concentrations. The highest concentration of dissolved solids and the lowest pH values were in Hurst Spring samples. The average ion concentration was 480 ppm; highest concentrations occurred during dry-weather flow. As the creek flows across formations of different lithologic hcaracter, the chemical character of its water changes in relation to the chemistry of the rocks. (Lang-USGS)
W71-02219

TRITIUM IN STREAMS IN THE UNITED STATES, 1961-1968,
Geological Survey, Wash., D.C.; Weather Bureau, Silver Spring, Md. Office of Hydrology; and Massachusetts Univ., Amherst. Coll. of Agriculture.
For primary bibliographic entry see Field 05B.
W71-02434

AUTOMATE KJELDAHL ANALYSES OF NITROGENOUS MATERIALS IN AQUEOUS SOLUTIONS,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 02K.
W71-02439

DETERMINATION OF PENTACHLOROPHENOL IN ORGANIC TISSUES AND WATER,
Swedish Water and Air Pollution Research Lab, Stockholm.
Lars Rudling.
Water Research, Vol 4, No 8, p 533-537, August 1970. 5 p, 1 fig, 5 tab, 1 ref.

Descriptors: *Pollutant identification, *Chemical analysis, *Chlorinated hydrocarbon pesticides, *Fungicides, Wood preservatives (Pesticides), Gas chromatography, Analytical techniques.
Identifiers: Pentachlorophenol.

A method for the determination of pentachlorophenol (PCP) in tissues and natural waters is described. The PCP is extracted from the acidified sample with n-hexane and then re-extracted into a borax solution. It is then acetylated by extracting with n-hexane containing acetic acid anhydride and pyridine. The resulting pentachlorophenyl acetate is analyzed by gas chromatography using an electron capture detector. The PCP content in fish from a lake into which PCP is discharged is reported. The data obtained indicate that PCP accumulate in aquatic organisms. The identity of the PCP was established by combined gas chromatographic--mass spectrometric analysis. (Knapp-USGS)
W71-02440

WATER RESOURCES DATA FOR COLORADO-1968: PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02470

OIL POLLUTION OF THE OCEAN,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02474

HYDROCARBON POLLUTION OF EDIBLE SHELLFISH BY AN OIL SPILL,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02475

A PREDATOR-PREY RELATIONSHIP. SEA STARS-BIVALVES. THE CHEMICAL BASIS OF THE RESPONSE OF ASTERIAS VULGARIS TO CRASSOSTREA VIRGINICA. A BIOASSAY, ITS APPLICATIONS AND THE PARTIAL PURIFICATION OF AN ACTIVE EXTRACT,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02477

WATER QUALITY STANDARDS FOR TEMPERATURE,
Federal Water Pollution Control Administration, Washington, D.C. Office of Program Planning and Development.
Robert S. Burd.
In: Engineering Aspects of Thermal Pollution, Chapter 3, p 72-77, 1969.

Descriptors: *Standards, *Temperature, Thermal pollution, Water quality, Fish, Environmental effects, Water pollution, Heated water.

Summary of water quality standards approved by FWPCA referring to the temperature and temperature increase caused by thermal discharges are discussed. The water quality standards vary significantly from state to state, both numerical and narrative approaches were used by most states. Numerical criteria were tailored to the type of fishery to be protected. Numerical limits generally referenced a seasonal maximum, allowable change from background temperatures, and occasionally a rate of change. There is felt a necessity of proper definition of mixing zone. The proposals for further research is stated. (See also W71-02478) (Novotny-Vanderbilt)
W71-02480

RESEARCH NEEDS FOR THERMAL POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D.C.
J. Frances Allen.
In: Biological Aspects of Thermal Pollution, Chapter 12, p 382-391, 1969. 11 ref.

Descriptors: *Thermal pollution, *Research and development, *Environmental effects, *Temperature, *Fish, *Fish food organisms, Self-purification, Water pollution, Water quality, Ecology, Food chains, Ecosystems.

Research needs for freshwater, marine, and estuarine life have not been treated separately, for the needs are similar. Knowledge of the organisms occupying any of these environments is so inadequate that it is necessary to have some kind of investigations. Design of such studies would be adapted to meet the unique and diverse conditions of a given situation. Immediate attention should be directed toward the determination of the effects of temperature on reproduction and growth of important fishes, shellfish, or other desired harvestable crop. This should be followed closely by, or simultaneously with, the determination of thermal effects on food-chain organisms. This approach is required for all life-history stages. Research should reduce the lack of knowledge on thermal effects in conjunction with other parameters, particularly on long-term effects, direct and indirect. Effects on other physiological processes, migratory behavior, ecological stability, increased sensitivity to toxicity, susceptibility to disease, and predator-prey relationships must be considered. Long-term effects should be stressed. More definitive work should be focused on temperature effects on the alteration of the environment, including salinity, temperature, current patterns, and chemical exchange. Although much data are available, especially on salinity and current patterns, more refined techniques are required to analyze the implications and interpretations of these data. Definitive surveys must be initiated in areas of temperate, subtropical, and tropical waters, where thermal loading is a distinct possibility. The influence of increased temperatures on the nutrient cycle, with subsequent eutrophications as a strong possibility, should receive due recognition. (See also W71-02491) (Novotny-Vanderbilt)
W71-02498

THE REMOTE SENSING OF OIL SLICKS BY RADAR,
Naval Research Lab., Washington, D.C.
N. W. Guinard, and C. G. Purves.
Available from NTIS as AD-709 982, $3.00 in paper copy, $0.95 in microfiche. April 1970. 10 p. NRL Proj RO7-02.
Identifiers: *Water pollution, Oils, *Radar, Sensors, *Oils, Detection, Airborne, Oil slicks.

The NRL Four frequency Radar System, at Coast Guard request, was flown over the oil slick caused by the wreck of the tanker Arrow in the Chedabucto Bay area of Nova Scotia on 17 February 1970. The oil slick was mapped remotely from an EC-121 aircraft in both the horizontal and vertical polarizations. Synthetic aperature imagery was obtained in the P,X,L and C-band. This data clearly established the value of the radar sensing techniques as a tool for locating and monitoring oil spills.
W71-02615

CARBON MONITOR,
Automated Environmental Systems, Inc.
Frank R. Boucher.
Instruments and Control Systems, Vol 43, No 1, p 22-23, January 1970. 1 fig.

Descriptors: *Carbon, *Organic matter, *Monitoring, *Infrared radiation, Carbon dioxide, Instrumentation.
Identifiers: *Total organic carbon, Infrared analyzer.

A new total organic carbon (TOC) monitor has been developed which provides continuous measurement with no manual pretreatment or manipulation. The instrument consists of a sample feed and pretreatment system, which removes inorganic carbon from the effluent stream; an oxidation system, which converts the organic carbon to carbon dioxide; and an infrared analyzer which measures the carbon dioxide and produces a signal directly proportional to TOC in the stream. The effluent produced by the monitor contains gaseous water, carbon dioxide and oxygen, plus oxidation products of noncarbonaceous compounds. The carbon dioxide in the effluent is proportional to the total organic carbon in the sample stream. (Little-Battelle)
W71-02672

A RAPID, NONDESTRUCTIVE TECHNIQUE FOR INFRARED IDENTIFICATION OF CRUDE OILS BY INTERNAL REFLECTION SPECTROMETRY,
James S. Mattson, Harry B. Mark, Jr., Ronald L. Kolpack, and Clarence E. Schutt.
Analytical Chemistry, Vol 42, No 2, p 234-238, February 1970. 5 fig, 2 tab, 17 ref.

Descriptors: *Oil, *Spectrophotometry, Chemical analysis, Data processing.
Identifiers: *Internal reflection spectrometry, *Crude oil, *Tar, *Santa Barbara channel, Platform A Infrared spectrometry.

A rapid, direct, and qualitative internal reflection spectroscopic (IRS) technique for the identification and differentiation of crude oils and tars is presented. The sample needs no pretreatment and may either be a liquid or mixed with a solid substrate. As IRS is relatively more sensitive than transmission spectroscopy over an extended portion of the infrared, the use of IRS results in a better sample spectrum. The results of this study show that differentiation of crude oil samples originating both from Platform 'A' and from natural seepages in the Santa Barbara Channel is possible, based upon the presence of carbonyl and carbon monoxide-like bands observed only in the natural seepage samples. Representative examples of IRS taken for crude oils are included in the article. A discussion is also included on data treatment. (Little-Battelle)
W71-02673

THE DETERMINATION OF CYANIDE IONS IN WATERS AND EFFLUENTS BY AN AUTO-ANALYZER PROCEDURE,
P. Casapieri, R. Scott, and E. A. Simpson.
Analytica Chimica Acta, Vol 49, p 188-192, January 1970. 1 fig, 4 tab, 7 ref.

Descriptors: *Automation, *Effluents, *Colorimetry, *Waste water (Pollution), *Sewage effluents, Trace elements.
Identifiers: *Auto-Analyzer, *Cyanide, Interference, Aldridge method.

After a review of analytical methods for cyanide determination, the conclusion was reached that the most satisfactory colorimetric procedure is the Aldridge method which is based on the Koenig synthesis. In this procedure, cyanide is brominated to cyanogen bromide, excessive bromine is removed by a reductant, and cyanogen bromide is coupled with pyridine and an aromatic amine to give a colored complex. In order to handle large numbers of samples, this method was adapted for use with the Auto-Analyzer. An important feature of the procedure is the distillation stage, which not only improves the selectivity of the method, but also eliminates the necessity of filtering samples containing particulate matter. The distillation stage is designed to give a sample rate of 40 samples/h. Analysis of 1000 water samples (mostly trade effluents) by manual methods and by using the Auto-Analyzer showed excellent correlation between the results. The range of 0.5 to 10 p.p.m. of cyanide ions was of primary interest, but it was found that Beer's law was obeyed up to 40 p.p.m. of cyanide without any change within the system. Tables are included which show the results of the tests as well as interferences that result from lead, nickel, copper, mercury, cyanate, thiocyanate, thiosulfate, bisulfite, nitrite, hypochlorite, formaldehyde, and phenol ions. (Little-Battelle)
W71-02674

FAST-RESPONSE OXYGEN SENSOR TESTED.

Commercial Fisheries Review, Vol 32, No 2, p 22-23, February 1970. 1 tab.

Descriptors: *Dissolved oxygen, *Dissolved oxygen analyzers, *Sea water, Nansen bottles, Water quality, Water analysis.

Ocean oxygen measurements conducted by a civilian oceanographer of the U. S. Naval Oceanographic Office indicate that a new oxygen sensor may replace the old Nansen bottle method. The new sensor is a one-step method which can provide continuous oxygen measurements while it is being lowered through various ocean depths. The sensor produces an electrical signal which is transmitted up through an oceanographic cable to the ship. A sample chart shows the levels of dissolved oxygen at various steps determined during one of the preliminary tests. (Little-Battelle)
W71-02676

MEASUREMENT AND SIGNIFICANCE OF ADENOSINE TRIPHOSPHATE IN ACTIVATED SLUDGE,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
James W. Patterson, Patrick L. Brezonik, and Hugh D. Putnam.
Environmental Science and Technology, Vol 4, No 7, p 569-575, July 1970. 10 fig, 1 tab, 26 ref.

Descriptors: *Activated sludge, *Biomass, *Metabolism, *Inhibitors, Separation techniques, Spectrometers, Toxicity, Heavy metals, Hydrogen ion concentration, Enzymes.
Identifiers: *Adenosine triphosphate, Luciferin, Luciferase, Mercury, Enzymatic inhibitors.

A method of adenosine triphosphate (ATP) measurement in activated sludge has been developed from the firefly reaction of luciferin and luciferase with ATP, in which light production is proportional to ATP present. The purpose of the measurements was to utilize this parameter as a measure of metabolic activity and/or biomass. The ATP was extracted from the sludge by diluting it with 40 ml of boiling tris buffer and boiling it in a water bath for 10 minutes with occasional shaking. The ATP extracted was mixed with firefly tail extract, and the light emitted was measured by liquid scintillation spectrometer. A number of tests were conducted to determine the effect of temperature of ATP extraction, age and concentration of the reconstituted firefly lantern extract, and the presence of enzymatic inhibitors in the extracted samples. The technique has proved to be sensitive and reliable for quantitative determination of cellular ATP pool. ATP levels in activated sludge are relatively constant under endogenous conditions, indicating the potential of ATP as an estimate of viable biomass and respond rapidly to induced changes in metabolic activity. Advantages of an activity parameter over historically used biomass parameters for activated sludge operation control are manifold; ATP assay holds promise as a sensitive tool for future research on sludge activity in process control. (Little-Battelle)
W71-02677

POLYCHLORINATED BIPHENYLS,
David B. Peakall, and Jeffrey L. Lincer.
BioScience, Vol 20, No 17, p 958-964, September 1, 1970. 1 fig, 2 tab, 62 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Food chains, *Pesticide toxicity, Physical properties, Chemical analysis, Persistence, Absorption, DDT, Chemical properties, Plastics, Paints, Rubber, Resins, Gas chromatography, Spectrophotometry, Mallard duck, Poultry, Songbirds, Wading birds, Mussels, Herrings, Path of pollutants, Water pollution sources, Water pollution effects.
Identifiers: *Biological magnification, *Aroclors, *Polychlorinated biphenyls, Chemical structure.

The structural and physical properties, uses, analytical methods, toxicology, levels in nature, and biological magnification of PCBs, and the ratio of DDT to PCB in the environment are summarized. Although nothing is known about the biological decomposition of PCBs, it is likely that they are more stable than DDT and its metabolites and thus have a tendency to accumulate up the food chain. No figures on the amount of these materials produced annually are available. Analysis of PCBs has been carried out by means of a combination of high resolution gas chromatography and mass spectrometry. Nitration and saponification have been used to separate PCBs from other residues for analysis. Although several studies have been carried out on the toxicology of PCBs, toxic levels are still largely undefined. Studies have shown, however, that there are striking alternations in the internal organs of some mammals and birds. Data taken from several studies indicate that the PCBs are capable of biological magnification of the food chain. Because of the apparent danger of these materials it is necessary to discover the major sources of their escape into the environment. Sixty-two references have been cited in this summary. (Little-Battelle)
W71-02678

A HAND-OPERATED WINCH FOR BACTERIOLOGICAL WATER SAMPLING,
Hawaii Univ., Honolulu. Dept. of Microbiology.
For primary bibliographic entry see Field 07B.
W71-02679

SEPARATION OF PHENOLIC COMPOUNDS FROM CARBON CHLOROFORM EXTRACT FOR INDIVIDUAL CHROMATOGRAPHIC IDENTIFICATION AND MEASUREMENT,
James W. Eichelberger, Ronald C. Dressman, and James E. Longbottom.
Environmental Science and Technology, Vol 4, No 7, p 576-578, July 1970. 1 fig, 2 tab, 4 ref.

Descriptors: *Phenols, *Chemical analysis, *Separation techniques, Solvent extractions, Gas chromatography.
Identifiers: *Alkyl phenols, *Chlorophenols, *Aminophenols.

A procedure is presented for efficient isolation of many phenols from carbon chloroform extracts (CCE) prior to chromatographic identification. The phenols, as weak acids, are isolated by a Florisil column cleanup of the CCE. Techniques for evaporation and preparation of the extract are given. Application of the method to grab samples as well as qualitative and quantitative determinations are discussed. Recovery data and relative retention times for a gas-liquid chromatographic separation are reported. (Little-Battelle)
W71-02680

IMPACT OF AGRICULTURAL POLLUTANTS ON WATER USES,
Robert S. Kerr Water Research Center, Ada, Okla.
James P. Law, Jr., and Harold Bernard.
Transactions at the American Society of Agricultural Engineers, Volume 13, No 4, p 474-478, July-August 1970. 3 tab, 23 ref.

Descriptors: *Farm wastes, *Irrigation, *Salinity, *Pollutants, *Fertilizers, *Water pollution sources, Biochemical oxygen demand, Chemical oxygen demand, Disposal, Livestock, Agricultural chemicals, Aquatic life, Water quality, Fish, Dissolved oxygen, Aesthetics, Recreation, Pollutant identification.
Identifiers: *Agricultural pollutants, *Aesthetic value, Total salt, Primary contact recreation, Secondary contact recreation.

This paper discussed the water pollution potential of agricultural sources. Animal wastes, irrigation return flows, fertilizer application, and pesticides are the primary sources of agricultural pollutants. The water-quality criteria for water supplies are discussed as related to agricultural contaminants. Data is presented for the desirable and permissible limits of concentration for the various contaminants. Agricultural is responsible for a major portion of the total salt in many rivers and streams. Data is given for the proposed safe limits of water salinity for livestock. The impact that agricultural pollutants has on fish, other aquatic life, and wildlife is discussed. Examples are cited where pollutants have adversely affected fish and wildlife. Now is the time to build the cost of clean water into all of our operations. (Christenbury-Iowa State)
W71-02687

IDENTIFICATION OF GASES IN A CONFINEMENT SWINE BUILDING ATMOSPHERE,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. A. Merkel, T. E. Hazen, and J. R. Miner.
Transactions of the American Society of Agricultural Engineers, Vol 12, No 3, 1969, p 310-313 and 315. 5 fig, 1 tab, 11 ref.

Descriptors: *Farm wastes, *Hogs, *Odor, *Gases, Confinement pens, Sulfur compounds, Ammonia, Amino acids, Porteins, Carbohydrates, Lipids, Organic acids, Solubility, Hydrogen ion concentration, Chromatography, Alcohols, Sulfides, Salting, Absorption, Condensation, Pollutant identification.
Identifiers: Acid-forming, Methane-producing, Manure storage pit, Amides, Amines, Carbonyls, Esters, Mercaptans.

In addition to the already known fixed gases, CO2, CO, H2S, NH3, CH4, etc., the environment within a confinement swine unit was found to contain a complex mixture of volatile organic intermediates. These intermediates are important in the characteristic odor resulting from the storage of manure and are suspected as being important in animal and building performance. Consideration of physical as well as organic, biochemical phenomena indicated that the important intermediate products of anaerobic manure decomposition include organic acids, amines, amides, alcohols, carbonyls and sulfides. Qualitative chemical analysis confirmed the presence of these homologous groups, except for organic acids that were decomposed upon formation by the high pH maintained within the manure storage pit. To identify individual compounds within the swine environment, concentration of the volatile gases was required. Selective absorption, liquid salting and selective condensation were each used in an effort to separate and concentrate the homologous series. Once separated, the series were subjected to chromatographic analysis for separation and identification. Physiological odor investigations have been conducted to indicate the important compounds in the specific odors in swine buildings. Work to date indicates that the major odor constituents are from the amine and sulfide groups. Further work is under way to separate these compounds. (White-Iowa State)
W71-02692

SEEK DATA IN FEEDLOT RESEARCH.
South Dakota State Univ., Brookings.

South Dakota Farm and Home Research. Vol XXI, No 2, Spring 1970, p 22-27. 2 tab, 8 fig.

Descriptors: *Farm wastes, *South Dakota, *Design criteria, Cattle fertilizers, Biochemical oxygen demand, Water pollution.
Identifiers: *Feedlots, *Farm terraces, Population equivalents, Constituents.

This is a preliminary report of research aimed at coming up with information that can be used by livestock producers, governmental agencies and persons concerned with commercial feedlot design and construction. Some advantageous conditions for feedlot expansion in South Dakota are discussed. Pollution constituents in animal waste and runoff quantities are considered in making some general recommendations as to the design or layout at a feedlot. Six sketches are utilized in presenting some do's and don't's in feedlot design. (Christenbury-Iowa State)
W71-02694

WILSCHWITZ RUNOFF SAMPLER,
Wisconsin Univ., Madison. Dept. of Agricultural Engineering.
S. A. Witzel, J. T. Wilke, and F. L. Schmitz.
Transactions of the American Society of Agricultural Engineers, Vol 11, No 6, 1968, p 883, 886. 3 fig, 1 ref.

Descriptors: *Runoff, *Nutrients, *Sampling, Farm wastes, Weirs, Nitrogen, Phosphorus, Potassium, Water levels, Pollutant identification.
Identifiers: Prediction equations, Wilschwitz sampler, Water stage recorder.

The sampler was developed for the purpose of automatic collection of water samples from the flood runoff of small watersheds. It was intended to be used for measuring plant nutrient contained in runoff and not for determining suspended sediment loads. The installation of the Wilschwitz sampler in conjunction with a weir and water stage recorder provides an inexpensive means of obtaining runoff samples at various stages. The unique feature of the sampler is that it operates without auxiliary power. Details of the sampler's construction and operation are given in the article. Data gathered with this sampler are to be used in developing prediction equations relating the rates and amounts of runoff to the plant nutrients lost. If such correlations can be made, equations may be programmed to estimate amounts of nitrogen, phosphorus, potassium or other elements that may be anticipated in the surface water runoff. (White-Iowa State)
W71-02695

MOISTURE INCREASES MANURE ODORS,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
D. C. Ludington, and A. T. Sabel.
Poultry Digest, September 1970, p 445-446. 1 fig, 2 tab, 1 pic.

Descriptors: *Farm wastes, *Odors, Air pollution, Poultry, Ammonia, Hydrogen sulfide, Waste dilution, Chromtography, Organic acids, Pollutant identification.
Identifiers: Masking agents, Counteractants, Deodorants, Organoleptic test.

Studies of handling livestock wastes have shown that increased dilution facilitates faster settling of manure solids; thus requiring constant agitation for efficient removal of solids. Despite some apparent handling advantages of diluted animal wastes, other considerations such as lack of odor control, quantity of material to be handled, availability of water for dilution, and certain pollution may combine to preclude handling as liquid waste. Odor strengths of animal manures have been measured using liquid dilution and vapor dilution. Agitation of liquid manure causes odors to be released and their strength to increase rapidly. A combination of gas chromotographic and organoleptic techniques have been used to determine the chemical compounds responsible for the offensive odor of accumulated liquid poultry manure. Organoleptic tests indicate that the organic acids, mercaptans and sulfides are especially important malodorous components, in addition to the odorous gases ammonia and hydrogen sulfide. An organoleptic test was developed for evaluating over 40 commercial odor control products to use with liquid waste. Masking agents and counteractants were found to be the most effective. The better procedure for controlling air pollution is to prevent the formation of odors rather than attempt to control. A manure-handling system that incorporates moisture removal apparently has some merit. (White-Iowa State)
W71-02699

MEASUREMENT OF THE ODOR STRENGTH OF ANIMAL MANURES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 260-270. 6 fig, 4 tab, 10 ref.

Descriptors: *Farm wastes, *Odor, Poultry, Anaerobic conditions, Pollutant identification, Waste water treatment.
Identifiers: *Vapor dilution, *Threshold Odor Number, *Odor Intensity Index, Liquid dilution, Panel, Batch condition, Odor strength, Ranking.

Strength is a characteristic of an odor that can be measured. In contrast to characteristics such as quality and occurrence which rely only on individual opinion, strength allows associating a number with an odor. This can be very valuable for comparing manure handling systems as to odor production. Measurement of odor strength is usually accomplished by determining the magnitude of dilution required so that the odor is just detectable (olfactory threshold). The human nose is utilized as the detector. The application of the measurement of odor strength to animal manures was attempted in the laboratory. The method of liquid dilution and the method of vapor dilution were investigated. Vapor dilution looks at the odors arising from the manure while liquid dilution is concerned with the odors in the manure or the odor potential of the manure. Fifteen conclusions and observations were made as a result of the study. (White-Iowa State)
W71-02733

TYPICAL VARIATIONS ENCOUNTERED IN THE MEASUREMENT OF OXYGEN DEMAND OF ANIMAL WASTES,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
E. Paul Taiganides, and Richard K. White.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 327-335. 2 tab, 7 fig, 9 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, *Oxygen demand, Temperature, Hogs, Cattle, Poultry, Sheep, Pollutant identification, Waste water treatment.
Identifiers: *Warburg, *Sewage Seeding, *BOD oxygen probe, Dilution effects.

Tables and figures were presented to emphasize the inherent variability in the parameters used in measuring oxygen demand. Reliable values of oxygen demand are essential because they are used as design parameters in waste treatment plants. Past and present experiments are being done with large numbers of replicates for each experiment to determine a reliable range of values for the various oxygen demand parameters of animal wastes. BOD was expressed in milligrams of oxygen required per gram of total solid matter (mg O2/g TS) since values reported in ppm or mg/l are useless because of the large variability in solid content of the waste and the high dilutions needed for the BOD test. Three methods of determining the BOD of animal waste were tested. These were the standard test, the BOD oxygen probe and Warburg. Effects of temperature and seeding with sewage were also explored. (White-Iowa State)

W71-02738

5B. Sources of Pollution

COMBATTING SALT-WATER ENCROACHMENT INTO THE BISCAYE AQUIFER--MIAMI, FLORIDA AREA,
Dade County Public Works Department, Miami, Florida.
For primary bibliographic entry see Field 04B.
W71-02283

HARVEY REALTY CO V BOROUGH OF WALLINGFORD (RIPARIAN RIGHTS AND PROTECTION OF PUBLIC WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-02314

OZARK PIPE LINE CORP V DECKER (LIABILITY FOR STREAM CONTAMINATION BY OIL).
For primary bibliographic entry see Field 06E.
W71-02326

SMITH V STASO MILLING CO (DOCTRINE OF COMPARATIVE HARDSHIP NOT APPLICABLE WHERE POLLUTER FOREWARNED OF POLLUTION DANGER).
For primary bibliographic entry see Field 06E.
W71-02336

WYNN V WILSON (SEEPAGE FROM IMPROPERLY CAPPED OIL WELL ALLEGED TO HAVE DAMAGED SPRING AND LAND).
For primary bibliographic entry see Field 06E.
W71-02372

LAUMA V BUNKER HILL AND SULLIVAN MINING AND CONCENTRATING CO (EASEMENT TO DUMP WASTES).
For primary bibliographic entry see Field 06E.
W71-02386

A HYDROLOGICAL APPROACH TO CONTROL ACID MINE POLLUTION FOR LAKE HOPE,
Ohio Univ., Athens. Dept. of Geology.
For primary bibliographic entry see Field 05G.
W71-02427

TRITIUM IN STREAMS IN THE UNITED STATES, 1961-1968,
Geological Survey, Wash., D.C.; Weather Bureau, Silver Spring, Md. Office of Hydrology; and Massachusetts Univ., Amherst. Coll. of Agriculture.
T. A. Wyerman, R. K. Farnsworth, and G. L. Stewart.
Radiological Health Data and Reports, Vol 11, No 9, p 421-439, September 1970. 19 p, 2 fig, 20 tab, 10 ref.

Descriptors: *Tritium, *Streams, *United States, Data collections, Analysis, Artificial use, Nuclear explosions, Sampling, Precipitation (Atmospheric), Hydrologic cycle, Streamflow, Flow rates, Rivers, Methodology.
Identifiers: *Artificial tritium input, Tritium concentrations.

As part of its program of water resources investigations, the U. S. Geological Survey has been analyzing the tritium content of stream water since the early 1960's. The results of this sampling program for 20 streams in the conterminous United States and Alaska are tabulated along with relevant stream discharge data. The data show the effect on stream tritium concentration caused principally by thermonuclear detonations, and also seasonal, latitudinal, and continental effects. The Colorado River at Cisco, Utah, and most of the other sampled rivers reached their maximum tritium levels in 1963-1964, whereas the Colorado River near Yuma, Ariz., did not reach its highest level until 1966-1967. About a year after the maximum tritium concentration was reached in the Mississippi River, the concentration in the river at Luling, La., began to approximate about half the concentration near Anoka, Minn. The Yukon River carried the highest concentration derived from precipitation, whereas the Kissimee River had the lowest. Although their basins adjoin, the Potomac River had tritium levels significantly lower than the Ohio River. (Woodard-USGS)
W71-02434

LAKE STRATIFICATION CAUSED BY RUNOFF FROM STREET DEICING,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
John H. Judd.
Water Research, Vol 4, No 8, p 521-532, August 1970. 12 p, 3 fig, 6 tab, 16 ref.

Descriptors: *Density stratification, *Lakes, *Saline water, *Mixing, *Michigan, Water pollution sources, Path of pollutants, Deicers, Melting, Snow removal, Water quailty.
Identifiers: *Street deicing, *Street salting.

Salt is used for winter street deicing throughout most of the northern United States. Much of the salt is dissolved in the melt water and flows into surrounding surface water. Salt entering First Sister Lake, Michigan increased the density of the water in the lower lake strata. During 2 of the 3 yr studied, the increased density prevented complete spring overturn. This can be considered a temporary monomixis. The stability of stratification of the lake was computed. Stability was from 3.5 to 8.5 times greater than when no complete overturn occurred at other times. The lake mixed competely each fall. Laboratory and field tests indicate that salt left the lake and apparently entered the groundwater of the area. Dichtothermic conditions were found in the lake. Density determinations indicated that this was an unstable condition, probably of short duration. (Knapp-USGS)
W71-02441

OIL POLLUTION OF THE OCEAN,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W71-02474

THE COOLING OF RIVERSIDE THERMAL-POWER PLANTS,
Electricite de France, Paris.
Andre Goubet.
In: Engineering Aspects of Thermal Pollution, Chapter 4, p 110-123, 1969. 4 fig, 3 tab.

Descriptors: *Cooling, *Thermal pollution, Thermal power, Heat budget, Heat balance, Temperature, Mixing, Rivers.
Identifiers: France.

Three rivers were investigated in France as to their cooling ability of thermal discharges. For cooling computation, the following formula was used: T sub 2 — T sub 1 exp (-kLx/Q) where T sub 1 and T sub 2 are the excess over the equilibrium temperature in two sections of a canal (or river) a distance of x apart, L is the width of the canal, Q is the rate of flow. Recommended value of k (which may vary with meteorological conditions) is k — .000013. The measurements made in France provided the following major conclusions: (1) the mingling of warm and cold water downstream from a plant is a slow process which takes several kilometers before a nearly homogenous rise is obtained, (2) temperature increase resulting from passage through the condensers is almost always less than 8C. The ways of future research is discussed. (See also W71-02478) (Novotny-Vanderbilt)
W71-02481

DISCUSSION OF 'MECHANICS OF CONDENSER WATER DISCHARGE FROM THERMAL POWER PLANTS' BY D. R. HARLEMAN,
California Inst. of Tech., Pasadena. Dept. of Civil Engineering.
Norman H. Brooks.
In: Engineering Aspects of Thermal Pollution, p 165-172, 1969. 6 fig, 8 ref.

Descriptors: *Water cooling, *Mixing, *Heat transfer, Water pollution sources, Hydraulic design, Outlets, Thermal pollution.

The purpose of this discussion was to point out the possibility of making hydraulic designs for cooling water discharges considering all possible ranges between surface spreading of hot water with minimal mixing and extensive jet mixing of the effluent with the receiving water and with possible storage of waste heat below thermoclines. The different problems in each case are presented and some conclusions are: (a) The alternatives elected in the hydraulic design of outlet structures will certainly depend on the predicted ecological effects of managing the waste heat in different ways. The strong-mixing approach can be expected to be most useful in ocean or in reservoirs and estuaries in which there are substantial currents to carry away the waste heat from the plant site. In small bodies of water, or those without substantial currents, surface spreading will probably be more effective. (b) It is necessary to develop power generation methods which are more efficient and produce less waste heat per unit of power generated. (c) It is recommended to use the metric system of units in all calculations of heat transfer and energy. (See also W71-02478) (Guerrero-Vanderbilt)
W71-02483

MODELING OF HEATED WATER DISCHARGES,
Hydraulic Research Station, Wallingford (England).
Peter Ackers.
In: Engineering Aspects of Thermal Pollution, Chapter 6, p 177-212, 1969. 18 fig, 24 ref.

Descriptors: *Model studies, *Hydraulic similitude, Effluents, Buoyancy, Diffusion, Turbulence, Thermal pollution.
Identifiers: Heat exchange.

The purpose of this paper was to outline some of the more practical aspects of the modeling of buoyant effluents, including a comparison of model and prototype observations in several situations. The main stages of dispersion with their scale relationships are outlined such as jet diffusion, buoyant plume, convective spread, mass transport by ambient currents, ambient turbulence and surface cooling. A comparison between field studies and model results were made in several models: Severn Estuary model, Black Rock outfall/intake model, Power stations and Desalination plant in Hong Kong, Ringsend and Pigeon House Power station in Dublin, Longannet Power Station on the Forth Estuary in Scotland, and proposed 2,400 MW station at Heysham in Lancashire, covering a wide variety of situations. The underlying principles and some of the special equipment used for field surveys at the Hydraulic Research Station, Wallingford, Berks, are presented. Conclusions were: (a) Hydraulic model techniques must be supported by adequate field surveys and its limitations must be realized. Some of the imperfections of modeling are inseparable, but continued research on densimetric and turbulent processes must help to improve the interpretation of scale-model results. (b) The model-prototype comparisons that have been given show that reasonably good agreement is possible, although there remains the problem of the representation of initial mixing zones in vertically exaggerated models. The use of two models, one being a large scale local one of the immediate locality of the outfall, is therefore often advisable. (c) Expenditure in field surveys may form an appreciable proportion of total investigation costs. (d) Infrared techniques are promising in survey methods

in model as well as in prototypes. (See also W71-02478) (Guerrero,Vanderbilt)
W71-02484

DISCUSSION OF 'MODELING OF HEATED DISCHARGES' BY PETER ACKERS,
Tennessee Valley Authority, Norris. Engineering Lab.
Edward E. Driver, and Rex A. Elder.
In: Engineering Aspects of Thermal Pollution, p 213-221, 1969. 3 ref, 2 fig.

Descriptors: *Model studies, *Hydraulic similitude, Outlets, Thermal pollution.
Identifiers: Heat exchange.

A discussion on mass transport by ambient currents and roughness relationship is made and also the simulation of heat exchange with the environment is analyzed, pointing out the implications involved in surface cooling simulation. It is remarked that existing analytic techniques serve to provide a basis for a preliminary estimate of the requirements for a condenser water intake and outlet system; but to insure a proper design, model studies in most cases will be necessary. A brief description of a model study of the condenser water discharge canal for the Cumberland Steam Plant, currently being conducted at the Tennessee Valley Authority's Engineering Laboratory is presented. Three problem areas were identified: (1) The rapidly divergent transition at the upstream end of the discharge canal did not distribute the flow properly, (2) flow separation occurred at the bend, and (3) undesirable mixing occurred near the mouth of the canal. To determine the effect of the transition on the problems, a baffle was installed but it did not alleviate these undesirable conditions. Considerable work remains to be done to determine the best configuration for the discharge canal. (See also W71-02478) (Guerrero-Vanderbilt)
W71-02485

BIOLOGICAL ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W71-02491

ENGINEERING ASPECTS, SOURCES, AND MAGNITUDE OF THERMAL POLLUTION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Peter A. Krenkel, and Frank L. Parker.
In: Biological Aspects of Thermal Pollution, Chapter 12, p 10-72, 1969. 28 fig, 5 tab, 32 ref.

Descriptors: *Thermal pollution, Stratification, Water quality, Dissolved oxygen, Iron, Manganese, Power plants, Cooling water, Waste assimilative capacity, Cooling towers, Temperature.
Identifiers: Dry cooling towers.

A general survey is conducted of the engineering aspects of thermal pollution. It describes thermal stratification in impounded waters and the effects of stratification on water quality, discussing in particular the dissolved oxygen balance, iron and manganese, and temperature. The overflow versus completely mixed heated discharges are compared and advantages of each are discussed. Also treated are heat additions from power plants; future cooling water requirements; fluctuating discharges of heated water; effects of heated discharges on waste assimilation; mechanisms for the dissipation of heat; the energy balance and its components; alternative methods for cooling water, such as cooling pond, spray pond, atmospheric towers, hyperbolic towers, mechanical draft towers, and dry cooling towers; the problems with cooling towers, and their cost. Addition of too much heat, either natural or artificial, causes adverse effects on water quality. It will be expensive to cool heated condenser water to its original temperature, but it can be done. (See also W71-02491 and W70-05059) (Rietveld-Vanderbilt)
W71-02492

SINCLAIR REFINING CO V KEISTER (LIABILITY FOR POLLUTION OF WATER SUPPLY BY LEAKAGE OF GASOLINE TANK).
For primary bibliographic entry see Field 06E.
W71-02534

YOUNG V INTERNATIONAL PAPER CO (LIABILITY FOR DESTRUCTION OF GROWING TIMBER BY FLOODING).
For primary bibliographic entry see Field 06E.
W71-02567

A DISPERSION MODEL FOR HEATED EFFLUENT FROM AN OCEAN OUTFALL,
Naval Postgraduate School, Monterey, Calif.
Richard Charles Baldwin.
Available from NTIS as AD-710 730, $3.00 in paper copy, $0.95 in microfiche. Master's Thesis, April 1970. 58 p, 13 fig, 3 tab, 28 ref.
Identifiers: *Sea water, Heat transfer, *Wastes (Industrial), Disposal, *Power plants (Establishments), Heat, Cooling, Two-dimensional flow, Mathematical models, Fluid flow, Surface temperatures, Pacific Ocean, Theses, Heat budget, Heat sinks, *Huntington Beach (Calif), *Thermal pollution.

A mathematical model is developed for dispersion of a heated effluent from an ocean outfall. Input parameters include atmospheric and oceanic conditions and discharge characteristics. The model solves the steady-state, two-dimensional differential equation for non-conservative diffusion of heat in a moving fluid. The solution is calibrated and verified using data from surveys conducted at the Southern California Edison Company power plant at Huntington Beach, California. Temperature fields predicted by the model are compared with the actual fields for seven different surveys. These comparisons indicate that the model can be used to predict the large scale influence of the outfall on the local ocean environment.
W71-02605

POLYCHLORINATED BIPHENYLS,
For primary bibliographic entry see Field 05A.
W71-02678

ENGINEERING ANALYSIS OF CATTLE FEEDLOTS TO REDUCE WATER POLLUTION,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-02685

IMPACT OF AGRICULTURAL POLLUTANTS ON WATER USES,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05A.
W71-02687

WILSCHWITZ RUNOFF SAMPLER,
Wisconsin Univ., Madison. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-02695

SOME CAUSES OF WET POULTRY MANURE,
Georgia Univ., Athens.
O. W. Charles.
Georgia Poultry Tips, August 1, 1970. Poultry Digest, September 1970, p 431.

Descriptors: *Farm wastes, *Poultry, *Moisture content, Water consumption, Strain, Salts, Carbohydrates, Lipids, Proteins, Water pollution sources.
Identifiers: *Ration, Water intake, Uric acid.

Excessive moisture in poultry manure may be due to a number of factors, among which is a tendency for certain strains of birds to produce higher percentage of moisture in the fecal material than other strains. Water represents by far the largest portion of fresh poultry manure. Reports of several researchers are cited as to moisture content and differences in strain. It was found that moisture content of the droppings of low water consuming strains was only 50%, while moisture content of droppings in the high water consuming strain reached 71%. Excessive amounts of salt and a concept of balance in the ration are also discussed as causes of excessive moisture. (White-Iowa State)
W71-02697

ANIMAL WASTE MANAGEMENT.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05D.
W71-02701

THE NITROGEN PROBLEM IN THE LAND DISPOSAL OF LIQUID MANURE,
Guelph Univ. (Ontario). Dept. of Soil Science.
L. R. Webber, and T. H. Lane.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 124-130. 3 tab, 1 fig, 13 ref.

Descriptors: *Farm wastes, *Nitrogen, *Groundwater, Nitrates, Water pollution sources, Waste water treatment.
Identifiers: *Nitrogen pollution, Crop utilization, Pollution control.

Segments of research are presented that lead to the preparation of guidelines outlining the cropland requirements for the utilization and disposal of the nitrogenous compounds in liquid manures. The objective in land spreading was two-fold: (a) to apply the waste at such rates that the practice will be nitrogen utilization for crop production at optimum use-efficiency; and (b) to apply the waste at such rates that the practice becomes primarily one of disposal while not contributing to environmental pollution (air, water, soil). Tables show the different rates of application and how the nitrogen is removed. Recommendations are given as to how much land is required for crop utilization and pollution control for different livestock operations. (White-Iowa State)
W71-02718

WASTE DISPOSAL MANAGEMENT,
Cornell Univ., Ithaca, N.Y.
Charles E. Ostrander.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 242-244.

Descriptors: *Farm wastes, Nitrogen, Mortality, Water pollution effects, Incineration, Storage, Odor, Disposal, Water pollution sources.
Identifiers: Compost, Nuisance, Pollution hazard, Residential areas, Neighbors.

The immediate concern of the author was the improvement and the prevention of further destruction of our environment. He spoke of the magnitude of the agricultural waste problem indicating the greatness of the technological and economic aspects. The importance of animal waste as a source of organic nitrogen was pointed out, as were the dangers of inorganic nitrogen. Methods of handling and storage were brought out. The problem of disposing of mortality cases and possible solutions was discussed. Stress was placed on the creation of a favorable image of agriculture in the eyes of the public. (White-Iowa State)
W71-02729

ROLE OF EXCRETED ANTIBIOTIC IN MODIFYING MICROBIAL DECOMPOSITION OF FEEDLOT WASTE,
Colorado State Univ., Fort Collins. Dept. of Microbiology.

S. M. Morrison, D. W. Grant, Sister M. P. Nevins, and Keith Elmund.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 336-339. 1 tab, 2 ref.

Descriptors: *Farm wastes, *Antibiotics, Cultures, Cattle, Confinement pens, Biodegradation, Pesticide residues, Assay, Water pollution sources.
Identifiers: *Chlortetracycline, *Biological stabilization, Feedlot, Manure decomposition, Microbial decomposition, In situ manure.

The results presented in this paper are derived from studies on the process of biological stabilization of feedlot manure and the acceleration of the stabilization process. It is a specific study on some microbial inhibitions which may be playing a role in the biodegradation of feedlot waste. Samples of manure were taken from pasture, in situ manure from feedlot pens, and stockpiled manure from a feedlot. Cultures of the filter-sterilized manure extract gave rather conclusive evidence that the substance causing growth inhibition in the extracts was chlortetracycline residue in the excreted manure. It was calculated that 75% of the ingested antibiotic was excreted in the feces. Temperature tests indicate that during the winter months biodegradation of manure is not only inhibited by cold temperatures but also by the persistence of the antibiotic residue and the continuous deposition of antibiotic containing fresh manure. (White-Iowa State)
W71-02739

5C. Effects of Pollution

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02217

SHERIFF V CITY OF EASLEY (RIGHT TO FLOW OF UNCONTAMINATED STREAM THROUGH PRIVATE PROPERTY).
For primary bibliographic entry see Field 06E.
W71-02273

NUTRIENT REMOVAL FROM ENRICHED WASTE EFFLUENT BY THE HYDROPONIC CULTURE OF COOL SEASON GRASSES,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05D.
W71-02277

MICROBIAL FACTOR IN MINE DRAINAGE FORMATION,
Mellon Inst., Pittsburgh, Pa.
For primary bibliographic entry see Field 05G.
W71-02278

COLLINS MFG CO V WICKWIRE SPENCER STEEL CO (UPPER RIPARIAN PROPRIETOR MAY NOT POLLUTE WATER TO THE INJURY OF LOWER RIPARIAN PROPRIETOR).
For primary bibliographic entry see Field 06E.
W71-02324

CARETTI V BRORING BLDG CO (LIABILITY FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W71-02424

OIL POLLUTION OF THE OCEAN,
Woods Hole Oceanographic Institution, Mass.
M. Blumer.
In: Oil on the Sea, New York, 1969, p 5-13. 1 fig, 10 ref. FWQA Project 18050 EBN.

Descriptors: *Oily water, *Water pollution effects, *Water pollution sources, Water pollution treatment, Sea water, *Oil wastes, Oil, Pollutant identification, Toxicity, Water pollution control.
Identifiers: Oil pollution, Oil spillage.

The extent of oil pollution of the seas is discussed on a world-wide scale. Contribution from shipping losses alone is estimated at 10 to the 12th power grams per year. The relative toxicities of various oil fractions to marine organisms are discussed and the potential for subtle long-term effects is emphasized. Oil mass identification and the potential biological effects of several oil spill countermeasures are briefly presented. (Hegre - FWQA National Marine Water Quality Laboratory)
W71-02474

HYDROCARBON POLLUTION OF EDIBLE SHELLFISH BY AN OIL SPILL,
Woods Hole Oceanographic Institution, Mass.
M. Blumer, G. Souza, and J. Sass.
Marine Biology, Vol 5, No 3, p 195-202, March 1970. 4 fig, 1 tab, 17 ref.

Descriptors: *Oily water, *Shellfish, *Water pollution effects, *Analytical techniques, *Degradation, Oysters, Gas chromatography, Sea water, Toxicity, Massachusetts, Water pollution sources, *Pollutant identification.
Identifiers: *Natural hydrocarbons, Scallop, Mass spectrometry, *Oil spillage, Oil pollution, Hydrocarbons (Aromatic), Buzzards Bay (Mass).

A spill of 650,000 to 700,000 of No. 2 fuel oil has contaminated the coastal areas of Buzzards Bay, Massachusetts (USA). Gas chromatography demonstrates the presence of this oil in the sediments of the affected area. Two months after the accident, essentially unchanged oil is still being released from the sediments. The presence of the same pollutant is demonstrated in whole oysters Crassostrea virginica and in the adductor muscle of the scallop Aequipecten irradians. A presumably biochemical modification leads to a gradual depletion of the straight chain and, to a lesser extent, of branched chain hydrocarbons. This does not result in detoxification, as the more toxic aromatic hydrocarbons are retained in the organisms several months after the accident. Scallops from an uncontaminated area contain hydrocarbons in lesser amounts and of very different molecular weight and type distribution; they are accountable entirely from biological sources. (Blumer-Woods Hole Oceanographic Institution)
W71-02475

A PREDATOR-PREY RELATIONSHIP. SEA STARS-BIVALVES. THE CHEMICAL BASIS OF THE RESPONSE OF ASTERIAS VULGARIS TO CRASSOSTREA VIRGINICA. A BIOASSAY, ITS APPLICATIONS AND THE PARTIAL PURIFICATION OF AN ACTIVE EXTRACT,
Woods Hole Oceanographic Institution, Mass.
K. J. Whittle, and M. Blumer.
Technical Report, Woods Hole Oceanographic Institution, Reference No 70-20, May 1970. 15 fig, 11 tab, 120 ref. ONR Contract N00014-66-C0241-6, NR 083-004, FWQA Project 18050 EBN, NSF Grant GA-1625, API Grant 85A.

Descriptors: *Attractants, *Molluscs, *Predation, *Bioassay, Chemical analysis, Oysters, Sea water, Fish, Water pollution effects, Pollutant identification, Spectroscopy, Analytical techniques.
Identifiers: *Echinoderms, *Starfish, Chemotaxis.

The chemical basis of the predator/prey relationship, sea stars/bivalves, was examined. Under controlled conditions in a flow-tank, Asterias vulgaris senses intact oysters (Crassostrea Virginica) upstream at distances of at least 120 cm. and shows a positive chemotaxis. It responds similarly to aqueous extracts of oyster tissue at concentrations as low as a few parts per billion. The threshold sensitivity of Asterias vulgaris and Asterias forbesi for an oyster extract was compared. It was measured also for A. vulgaris relative to other bivalves. Contamination of the testing tank with particulate suspensions and oil dispersions at concentrations of less than 10 mg/liter is sufficient to decrease the response to oyster extract and to lower the threshold sensitivity of the sea stars. A reliable, repeatable method was developed for the partial purification of the oyster extract. Infrared spectroscopy indicates that the major functional groups are -OH, -NH and -COOH. It is probable that the activity is centered in a number of polar, low molecular weight compounds (m.w. below a few hundred). They are heat stable at 100C, stable to acid, and not hydrolyzable. (K. J. Whittle-Woods Hole Oceanographic Institution)
W71-02477

ENGINEERING ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.

Proceedings of the National Symposium on Thermal Pollution Sponsored by Federal Water Pollution Control Administration and Vanderbilt University, Nashville, Tenn., August 14-16, 1968. Price: $7.95. Frank L. Parker and Peter A. Krenkel, Editors Vanderbilt University Press, Nashville, Tennessee, 1969. 407 p.

Descriptors: *Thermal pollution, *Thermal powerplants, *Economics, *Ecology, *Standards, *Thermal discharges, *Model studies, *Cooling towers, *Cooling water, Temperature, Aquatic environment, Legislation, Screens, Fish, Engineering.

This book is the proceedings of the National Symposium on Thermal Pollution and contains papers regarding the ecological changes of applied significance induced by the discharge of heated waters, the economic considerations in thermal discharge to streams, and several presentations dealing with the engineering aspects of thermal pollution. The cooling of riverside thermal-powerplants, the mechanics of condenser-water discharge from thermal-powerplants, the mathematical and physical modeling of heated-water discharges, and the design and operation of cooling towers were discussed in detail. The horizontal traveling screen for prevention of the entrance of fish into cooling water intake canals, and the development and administration of water quality standards for temperature were also discussed. A summary of the status of thermal pollution control and abatement is included. Each presentation includes a review of past and current research in that specific area and makes recommendations for future applied research. The concluding presentation summarizes the research needs for thermal pollution control. (See also W71-02479 thru W71-02490) (Speakman-Vanderbilt)
W71-02478

ECOLOGICAL CHANGES OF APPLIED SIGNIFICANCE INDUCED BY THE DISCHARGE OF HEATED WATERS,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
H. A. Hawkes.
In: Engineering Aspects of Thermal Pollution, Chapter 2, p 15-57, 1969. 4 tab, 3 fig, 84 ref.

Descriptors: *Temperature effects, *Thermal pollution, *Ecology, Algae, Bacteria, Coliforms, Fish, Fungi, Heat, Water pollution, Streams, Rivers, Lakes, Physiological ecology, Limiting factors, Ecosystems, Microorganisms, Aquatic microorganisms, Enzymes.

The general review of ecological aspects of thermal pollution is discussed. Temperature of water is an ecological factor which influences all forms of biological life in water. The minimum, optimum, and harmful temperature ranges for all kinds of biota in waters is discussed. The temperature influences the microbiological organisms by its effects on enzymes, which are inactivated at high temperatures. The most obvious effect of the raised water temperature on fish is the direct autecologi-

cal one, affecting the distribution of each species according to their temperature tolerance ranges. The optimum temperature ranges for fish are presented, and indirect effects of raised temperature on fish are discussed (decrease of oxygen level, increase of toxicity effects, etc.). The paper also discusses the temperature effects on macro-invertebrates, algae, bacteria, and fungi. (See also W71-02478) (Novotny-Vanderbilt)
W71-02479

THERMAL POLLUTION,
Federal Water Pollution Control Administration, Washington, D.C.
Joe G. Moore, Jr.
In: Engineering Aspects of Thermal Pollution, Chapter 8, p 243-248, 1969.

Descriptors: *Thermal pollution, *Temperature, *Cooling water.
Identifiers: Ecological effect.

Since the end of World War II, construction of scores of new power-generating plants has resulted in a growing public concern about hot water. The sudden rise in public awareness has far outstripped our knowledge of the ecological effects of large discharges of heated water in our rivers, lakes and estuaries. It is estimated that by 1978 approximately one-sixth of the total fresh water run-off in the United States will be used for cooling and consdensing purposes. The cooling water requirements for the nuclear power facility at Browns Ferry, Alabama, on the Wheeler Reservoir will be 2.8 billion-gallons per day. The temperature increase in the cooling-water, from intake to discharge, will zoom 25F in six minutes. The use of diffuser pipes at the bottom of the reservoir is proposed for disposal of this water. Another example is the Turkey Point facility, which will increase its cooling water requirement from 192 million gallons now to 3.15 billion gallons per day by 1972. There is already evidence of a substantial temperature increase in Biscayne Bay, a national treasure. What will happen when cooling water volume is increased more than 16-fold is unknown. The effective methods of control of waste heat are cooling towers, dilution of waste heat, use of aerated ponds, recycling of condenser water and operating the plant at minimal level during periods when addition of heat would be more hazardous. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02487

SUMMARY AND STATUS OF THE ART,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05D.
W71-02490

BIOLOGICAL ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.

Proceedings of the National Symposium on Thermal Pollution, Sponsored by the Federal Water Pollution Control Administration and Vanderbilt University, Portland, Oregon, June 3-5, 1968, Price: $7.95. Peter A. Krenkel and Frank L. Parker, editors, Vanderbilt University Press, Nashville, 1969. 351 p.

Descriptors: *Thermal pollution, *Thermal powerplants, *Ecology, *Biota, *Temperature, *Aquatic environment, *Aquatic life, *Aquatic populations, Algae, Benthos, Zooplankton, Freshwater fish, Estuarine environment, Impounded waters, Freshwater algae, Anadromous fishes.

The proceedings of the National Symposium on Thermal Pollution - Biological considerations - are included in this book. A brief discussion of the engineering problems of thermal pollution includes stratification of impounded waters, the contribution of heat from power plants, cooling water requirements, natural heat dissipation mechanisms, and alternative methods for cooling water. Reports and discussions concerning the effects of thermal pollution on freshwater algae, marine zooplankton, British freshwater fishes, Anadromous fishes, and freshwater benthos are presented. The development of thermal requirements of freshwater fishes, theoretical considerations of thermal pollution on marine fishes at various life stages, and the potential effect of thermal alteration on marine and estuarine benthos are also discussed. Most presentations include reviews of past and current literature and recommendations, and the final presentation deals exclusively with research needs for thermal pollution. (See also W71-02492 thru W71-02498) (Speakman-Vanderbilt)
W71-02491

ENGINEERING ASPECTS, SOURCES, AND MAGNITUDE OF THERMAL POLLUTION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W71-02492

REMARKS ON THE EFFECTS OF HEATED DISCHARGES ON MARINE ZOOPLANKTON,
Scripps Institution of Oceanography, La Jolla, Calif.
J. B. Strickland.
In: Biological Aspects of Thermal Pollution, Chapter 3, p 73-77, 1969.

Descriptors: *Zooplankton, *Thermal pollution, *Hydrodynamics, *Aquatic life, Food chain, Dominant organisms, Aquatic environment, Ecology, Physics, Temperature, Thermal effects.
Identifiers: *Marine environment.

To date, little is known concerning the extent of the effect on the entire food chain and its indirections and feedbacks on any particular part of it. Although clearly more is known now than was known a decade ago, the more that is known, the more complicated and interreacting it becomes. Before meaningful predictions concerning marine zooplankton can be made, much more about the physics and hydrodynamics of the discharge process must be known. Not enought is known about the kinetics of the remineralization process. The basic problem is marine and probably freshwater ecology is one of manpower; the training of enough people of sufficient caliber to make intelligent predictions about the results of thermal pollution in the environment is not progressing fast enough. (See also W71-02491) (Speakman-Vanderbilt)
W71-02493

ASPECTS OF THE POTENTIAL EFFECT OF THERMAL ALTERATION ON MARINE AND ESTUARINE BENTHOS,
Oregon State Univ., Newport. Yaquina Bilogical Lab.
Joel W. Hedgpeth, and Jefferson J. Gonor.
In: Biological Aspects of Thermal Pollution, Chapter 4, p 80-118, 1969. 7 fig, 1 tab, 91 ref.

Descriptors: *Benthos, *Temperature, *Thermal pollution, Laboratory animals, Acclimatization, Marine animals, Aquatic life, Aquatic animals, Benthic fauna, Aquatic plants, Marine algae, Benthic flora, Estuaries, *Estuarine environment, Bays, *Fluctuation, Resistance, Life cycles, Growth stages.
Identifiers: Temperature ranges, Temperature requirements.

Laboratory experiments on thermal tolerances, death points, and the life, without reference to the natural conditions, including previous temperature experience and state of tide or season at which experimental material was gathered, have questionable utility in reference to what the organisms may actually do in nature. Intensive field studies with in situ measurements of the environment and the organisms, combined with continuous monitoring, especially of thermal gradients, are needed. Field evidence indicates that some intertidal herbivores are well adjusted to the temperature ranges from seawater to rather high air temperatures for varying periods of time, and that indeed such a temperature range may be an ecological requirement, rather than an environment to be endured. How extensive this may be, and to what degree it may apply also to subtidal organisms, remains to be determined. There is evidence indicating that some marine organisms do not flourish in a stable temperature regime but require the variation around the statistical mean. However, such temperature requirements are not yet established for many organisms, since most experiments involving laboratory culture are of comparatively short duration. In contrast to the observed ability of many marine organisms to withstand wide ranges of environmental temperatures at some stages of their life cycles, there is the growing body of evidence that comparatively small fluctuations in oceanic temperatures may influence the distribution and abundance of many species, especially those that occur in large populations. (See also W71-02491) (Speakman-Vanderbilt)
W71-02494

DEVELOPING THERMAL REQUIREMENTS FOR FRESHWATER FISHES,
Federal Water Pollution Control Administration, Duluth, Minn.
Donald I. Mount.
In: Biological Aspects of Thermal Pollution, Chapter 6, p 140-147, 1969.

Descriptors: *Temperature, *Fish, Thermal pollution, Fish food organisms, Food chains, Growth rates, Reproduction.
Identifiers: *National Water-Quality Laboratory, *Thermal requirements, Harvestable species, Temperature fluctuations.

The research undertaken at the National Water-Quality Laboratory is being concentrated on developing thermal requirements of the harvestable aquatic species (shell- and fin-fishes) and the critical food-chain organisms on which they feed. The two primary functions which cannot be altered if a satisfactory crop of fish is to be maintained are reproduction and growth. Therefore, research is now centered around determination of maximum temperatures at which normal growth and reproduction can occur without impairment; the extent to which temperatures may fluctuate without interfering with growth and reproduction; and whether cooler temperatures are necessary for reproduction to occur. Field study sites at the St. Croix River in Minnesota and at the Mississippi River at Monticello, Minnesota, are being used to study maximum temperatures at which some critical species will spawn and grow normally, and to study the effects of elevated temperatures on critical food-chain organisms respectively. (See also W71-02491) (Speakman-Vanderbilt)
W71-02495

SOME EFFECTS OF TEMPERATURE ON FRESHWATER ALGAE,
Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.
Ruth Patrick.
In: Biological Aspects of Thermal Pollution, Chapter 7, p 161-185, 1969. 53 ref.

Descriptors: *Algae, *Temperature, Diatoms, Photosynthesis.
Identifiers: *Blue-green algae, *Green algae, *Red algae, *Temperature tolerance, Optimum growth temperature, Condenser paggage.

Most of the common freshwater algae belong to the green algae, diatoms, red algae, and blue-green algae groups. In each of these major groups there are many species. These species cover a wide range of temperatures from those that prefer cool-water conditions to those that prefer very warm water

conditions. Each species has a range of temperature that it can tolerate and a range in which its growth is optimum. In general, the blue-green algae have more species that prefer temperatures from 35C upward, whereas the green algae have a relatively large number of species that grow best in temperatures ranging up to 35C. Most diatom species prefer temperatures below 30C. The effect of artificially increasing the temperature regime of a species tends to increase growth and photosynthesis so long as light is sufficient for these functions and the limits of temperature tolerance are not reached. As one approaches the limits of temperature tolerance for a species, cell division is repressed, as is photosynthesis, and the formation of reproductive cells may be repressed. The pattern of growth may be greatly altered. The temperatures at which species may successfully grow in the laboratory may be higher than those which occur in nature because of lack of competition with other species under natural conditions and the effect of predator pressure. Studies made concerning the effect on algae of passing them through a condenser indicate that if the temperature does not exceed 34-34.5C, little, if any, harm is done. (See also W71-02491) (Speakman-Vanderbilt)
W71-02496

EFFECT OF HEATED DISCHARGES ON FRESHWATER FISHES IN BRITAIN,
Ministry of Agriculture, Fisheries and Food, London (England).
John S. Alabaster.
In: Biological Aspects of Thermal Pollution, Chapter 11, p 354-370, 1969. 9 fig, 6 ref.

Descriptors: *Fish, *Thermal pollution, Thermal power, Cooling, Trout, Perches, Carp, Cooling towers, Heated water, Environmental effects, Fish management, Streams, Rivers, Food chains.
Identifiers: Britain, Great Britain, *Temperature effects.

The increase in temperature of the water used by electricity-generating stations for cooling purposes is often potentially lethal during the summer to trout and to the more sensitive species of coarse fish, such as roach, perch, and gudgeon, though not to tench and carp. Coarse fish are present in most rivers receiving these heated discharges but are rarely killed even close to the effluent outfall, probably because they avoid lethal conditions which are often confined to the surface layers, and also because those fish exposed to heated water in the neighborhood of outfalls have become partially acclimated to temperatures above normal and thus become more resistant. When fish are killed, effluent temperatures are higher than normal, either because of exceptional operating conditions or intentionally for experimental purposes, but many fish apparently escape successfully. Most danger occurs near the outfalls, particularly when effluent recirculates both in the river and through cooling towers. Effluent temperatures are not always potentially level, even in summer, and may attract roach, gudgeon, carp, tench, and bream. Indirect effects of heated effluents on fish in polluted rivers are likely to be important. (See also W71-02491) (Novotny-Vanderbilt)
W71-02497

POLYCHLORINATED BIPHENYLS,
For primary bibliographic entry see Field 05A.
W71-02678

PHOSPHORUS, NITROGEN, AND ALGAE IN LAKE WASHINGTON AFTER DIVERSION OF SEWAGE,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson.
Science, Vol 169, No 3946, p 690-691, August 14, 1970. 2 fig, 8 ref.

Descriptors: Sewage effluents, *Algae, *Phytoplankton, *Aquatic productivity, *Phosphates, *Nitrates, *Chlorophyll, Diversion, Carbon dioxide, Alkalinity, Epilimnion, Washington, Phosphorus, Nitrogen, Nutrients.
Identifiers: Lake Washington (Washington).

Because of the large amounts of phosphorus and nitrogen being added to Lake Washington from sewage effluent, a program was set up to divert all sewage from the lake. The first diversion of 11 treatment plants occurred in 1963. From 1963 to 1969, phosphate decreased to 28% of the 1963 concentration, but nitrate remained at more than 80% of the 1963 value. Free carbon dioxide and alkalinity remained relatively high. The amount of phytoplanktonic chlorophyll in the summer was very closely related to the mean winter concentration of phosphate, but not to that of nitrate or carbon dioxide. Phytoplankton counts have not been completed, but data are available on the chlorophyll content of the phytoplankton in the epilimnion. The relationship between the summer mean and the concentration of phosphate in the surface water during the previous winter strongly suggests that phosphorus is the most important limiting element in Lake Washington. Two included graphs show the mean winter values of phosphate, nitrate, chlorophyll, and surface phytoplankton; and correlation between surface values of phosphate and nitrate during the spring increase of phytoplankton when the concentrations of nutrients are decreasing. (Little-Battelle)
W71-02681

POLYCHLORINATED BIPHENYLS (PCB) SOLUBILIZED IN WATER BY NONIONIC SURFACTANTS FOR STUDIES OF TOXITY TO AQUATIC ANIMALS,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
V. Zitko.
Bulletin of Environmental Contamination and Toxicology, Vol 5, No 3, p 279-285, 1970. 2 fig, 1 tab, 8 ref.

Descriptors: *Atlantic salmon, *Toxicity, *Spectrophotometry, *Gas chromatography, *Absorption, *Surfactants, *Solubility, Chlorinated hydrocarbon pesticides, Solvation, Ultraviolet radiation, Fluorescence, Fishkill, Fresh water, Sea water, Bioassay, Water pollution effects.
Identifiers: *Aroclors, *Polychlorinated biphenyls.

This paper describes the solubilization of PCB in water by a nonionic surfactant, Corexit 7664; determination of concentration of the solubilized PCB by UV spectrophotometry and fluorescence; some properties of aqueous PCB solutions; and preliminary results on the toxicity of PCBs to Atlantic salmon (salmo salar) parr. The PCB preparations were Aroclor 1221 and Aroclor 1254 (containing 21% and 54% chlorine respectively). Solubilities of PCB were determined in both fresh and seawater. The toxicity tests were conducted using two flasks at each Aroclor concentration: one containing two fish, the other without fish. Initial concentrations were 0.9 and 2.5 mg/l for Aroclor 1254 and 0.9 mg/l for Aroclor 1221. The results of the tests are included in graphs. The following conclusions were made: (1) The determined levels of solubility of PCB in water were reached by very vigorous dispersing of the PCB in water, and it would be difficult to scale up this procedure. As indicated by the toxicity data, lethal levels would be reached only in the case of Aroclor 1221. (2) Solubilization of PCB in water by relatively nontoxic, nonionic surfactants is a reproducible and convenient method for dosing PCB in experiments with aquatic animals. (3) Concentration of the solubilized PCB can be readily monitored by spectrophotometry or by fluorescence at a rate of 20-30 analyses per hour; continuous monitoring is also possible. (4) There is no difference in optical properties between PCB solubilized in water by nonionic surfactants and true solutions of PCB in ethanol. (5) The preliminary tests indicate that PCB may be less toxic to Atlantic salmon parr than chlorinated hydrocarbon pesticides. (Little-Battelle)
W71-02682

IMPACT OF AGRICULTURAL POLLUTANTS ON WATER USES,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05A.
W71-02687

SOIL FERTILITY UNDER CONTINUOUS CULTIVATION IN NORTHERN NIGERIA. I. THE ROLE OF ORGANIC MANURES,
R. G. Heathcote.
Experimental Agriculture. Vol 6, No 3, p 229-237, 1970. 13 tab, 14 ref.

Descriptors: *Trace elements, *Limiting factors, Farm wastes, Fertilizers, Crop response, Deficient elements.
Identifiers: Organic fertilizers, Nigeria, Organic manures.

Soil acidity, incipient potassium deficiency, and a deficiency of one or more trace elements were limiting factors in three trials of long-term soil fertility changes under continuous cultivation in the Sudan Savanna zone of Nigeria. The effectiveness of organic manures is explained largely or wholly in terms of these factors, since no evidence has yet been found to suggest that the addition of organic matter as such is of value. (Christenbury-Iowa State)
W71-02690

ENVIRONMENTAL POLLUTION--NOW AND IN THE YEARS AHEAD,
Office of Science and Technology, Washington, D.C.
Donald R. King.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 4-8, 1969.

Descriptors: *Farm wastes, *Environment, Legal aspects, Research and development, Design standards, Waste treatment, Waste disposal.
Identifiers: *Agricultural Pollution, Resource conservation, Waste uses, Land planning.

The report points out several avenues that warrant research attention; among them the following: (1) The potential benefits to control which may result from changing the character of animal wastes. (2) Information is needed on present control approaches to make them more generally applicable. (3) The tremendous volume of animal wastes produced necessitates the development and application of new and more effective treatment and disposal methods. (4) Additional attention to potential uses for animal wastes would be desirable. (5) Land use planning also warrants emphasis. (6) Additional information also will be needed on the relationships of wastes to agricultural production which can be used to assist in establishing standards. (White-Iowa State)
W71-02703

WASTE DISPOSAL MANAGEMENT,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05B.
W71-02729

5D. Waste Treatment Processes

REMOVAL OF PHOSPHATE FROM WATER BY ALUMINUM AND IRON, PHASE II,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
Pa Ho Hsu.
Available from NTIS as PB-196 109, $3.00 in paper copy, $0.95 in microfiche. New Jersey Water Resources Research Institute, Technical Completion Report, December 1970. 5 p. OWRR Project A-021-NJ (1).

Descriptors: *Phosphates, Chemical precipitation, Water pollution, *Waste water treatment, Clay minerals, Aluminum, Iron compounds, Water purification.

Identifiers: *Phosphate removal, Aluminum phosphate, Iron phosphate.

Effects of foreign components on the precipitation of phosphate by aluminum and precipitation of phosphate by ion were studied. The effectiveness of hydroxy-aluminum polymers to precipitate phosphate is greatly influenced by the ratio of phosphate to aluminum and also by the nature and the concentration of the foreign componets (sulfate, fluoride, kaolinite and montmorillonite) present. Phosphate precipitation was greatly improved in some cases while reduced in others. The composition of the waste water to be treated and that of coagulants added must be taken into consideration in any laboratory study or practical process of phosphate removal from waste water. Samples were prepared by mixing Fe (NO3)3,NaH2PO4 and NaOH together and then analyzed for the concentrations of phosphate and iron remaining in solution and the composition of the precipitate. The optimum pH for phosphate precipitation greatly varies with the amount of phosphate relative to that of iron present. Phosphate forms stable soluble complexes, thus frequently causing difficulty in obtaining complete precipitation of phosphate and iron. Some irreversible or very slowly reversible steps are involved in the process of sample preparation. Therefore, for any laboratory study or practical waste water treatment, the process of mixing reactants must be carefully controlled. (Hsu-Rutgers)
W71-02272

NUTRIENT REMOVAL FROM ENRICHED WASTE EFFLUENT BY THE HYDROPONIC CULTURE OF COOL SEASON GRASSES,
Robert S. Kerr Water Research Center, Ada, Okla.
James P. Law, Jr.
Available from NTIS as PB-196 112, $0.95 in microfiche. For sale by the Superintendent of Documents, US Government Printing Office, Washington, D.C. 20402. Price $0.50, Order no I67.13/4:16080/1069. Water Pollution Control Research Series 16080---10/69, October 1969. 33 p, 13 tab, 3 fig, 10 ref. FWQA Program 16080---10/69.

Descriptors: *Hydroponics, Tertiary treatment, Waste water treatment, Grasses, Fescue, Waste assimilative capacity, Nutrients, Nitrogen, Phosphorus, *Sewage effluents, Effluents.
Identifiers: *Nutrient removal, Cool season grasses, Ryegrass, Nitrogen removal.

Grasses were grown in hydroponic culture tanks to evaluate their nutrient removal capabilities when supplied with secondary-treated sewage effluent as the sole source of plant nutrients. Statistical methods were employed to determine the effects of the grasses, flow rates, and seasons on nutrient removal. Two control tanks with gravel bed and no grass were maintained throughout the study, two were planted with tall (Ky 31) fescue, and two were planted with perennial ryegrass. Two flow rates were maintained in each pair of tanks, approximately one-day and two-day detention times. All six tanks were effective in reducing the oxygen-demanding organic content of the effluent. Total nitrogen content was reduced appreciably by the control tanks, but the grass tanks were significantly better at nitrogen removal. Total phosphorus concentrations were reduced only slightly by passage through the tanks. The fast flow rate tanks produced the greater grass yields, while the slow flow rate tanks were more effective in nutrient removal from the sewage effluent. From grass yield and analyses data, the amount of plant nutrient material removed by the grasses was small compared to the total quantity supplied. Further studies are suggested to determine economic factors and design parameters.
W71-02277

MICROBIAL FACTOR IN MINE DRAINAGE FORMATION,
Mellon Inst., Pittsburgh, Pa.
For primary bibliographic entry see Field 05G.
W71-02278

STUDIES RELATING TO MARKET PROJECTIONS FOR ADVANCED WASTE TREATMENT,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Louis Koenig.
Available from the NTIS as PB-187 862, $3.00 in paper copy, $0.95 in microfiche. FWQA, Cincinnati Water Research Laboratory, Robert A Taft Sanitary Engineering Center, Report WP-20-AWTR-17, December 1966. 72 p, 8 fig, 13 tab, 23 ref, 1 app. FWQA Project 17000--12/66, Contract PH-86-64-39.

Descriptors: *Waste water treatment, *Economics, Distillation, Adsorption, Electrodialysis, Water reuse.
Identifiers: *Ultimate disposal.

To assess the present status of waste water treatment, the type of treatment now in use and the amount of waste water discharged, were determined for the major streams in the country. About 4% of 100-mile river basins now have full secondary treatment. A study was made to determine the percentage of municipal waste water present in surface supplies of 155 cities of populations of 25,000 or more. The maximum was 18% and median was 3.5%. Consideration was given in this study to the possibility of logistical imbalances that might occur if advanced waste treatment was applied to nearly all waste waters. If a distillation-adsorption system was used, less than 6% of the nation's annual fuel consumption would be used and less than 0.5% of the total power generation would be required. Activated carbon needs, however, would double. If electrodialysis was applied, 4% of the national power would be required. Membrane production would have to increase several thousandfold. Ultimate disposal of concentrates by injection, incineration, pipelining, etc., would create no imbalances. (Selby-Texas)
W71-02279

FEASIBILITY OF GRANULAR, ACTIVATED-CARBON ADSORPTION FOR WASTE WATER RENOVATION,
Pittsburgh Chemical Co., Pa.
R. S. Joyce, and V. A. Sukenik.
Available from NTIS as PB-168 838, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A Taft Sanitary Engineering Center, Report AWTR-10, May 1964. 32 p, 1 app, 9 fig, 9 tab. FWQA Project 17020--05/64, Contract SAph-86-62-15.

Descriptors: *Waste water treatment, *Activated carbon, Adsorption, Cost, Alkylbenzene sulfonates, Detergents, Water reuse.
Identifiers: Packed beds, Reactivation.

This study was initiated to estimate the optimum bed depth and flow rates necessary for most economical use of the adsorptive properties of carbon and to examine the feasibility of regenerating the carbon. The results show that granular activated carbon in packed-bed column contractors remove much of the organic matter including alkybenzene-sulfonate from municipal waste water. The COD of a secondary effluent was reduced to about 12 to 20 ppm and the ABS was removed almost entirely. When an ABS breakthrough concentration of 0.5 ppm is used as a criterion of carbon exhaustion, the amount of carbon required for countercurrent contacting is less than one pound per 1,000 gallons. For the process to be economical the carbon must be reactivated and re-used. Thermal reactivation in a steam-air atmosphere was found to be technically feasible. With reactivation, the total cost of carbon adsorption was estimated to be less than 10 cents per 1,000 gallons for plants treating 10 mgd of waste water. (Selby-Texas)
W71-02280

ADVANCED WASTE TREATMENT RESEARCH PROGRAM.
Advanced Waste Treatment Research Program, Cincinnati, Ohio.
Available from NTIS as PB-168 837, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A. Taft Sanitary Engineering Center, Summary Report, AWTR-14, Jan 1962-June 1964, April 1965. 142 p, 24 ref, 56 fig, 9 tab. FWQA Project 17000-04/65.

Descriptors: *Waste treatment, *Adsorption, Foaming, Electrodialysis, Distillation, Freezing, Reverse Osmosis, Solvent extractions, Ultimate disposal, Waste water treatment.
Identifiers: Chemical oxidation.

Under an extensive contract research program, the Public Health Service's Advanced Waste Treatment Research Program, between January 1962, and June 1964, studied a wide range of physical-chemical separation processes to evaluate their effectiveness in purifying municipal and industrial waste waters. Laboratory investigations have shown that adsorption by granulated activated carbon is an effective method of removing organic contaminants but that other possible low-cost adsorbent materials studied failed to produce consistently effective organic removals. Studied were foaming of secondary effluent, single-pass electrodialysis, distillation, reverse osmosis, freezing, and solvent extraction with low-molecular-weight secondary and tertiary amines. In anticipating various approaches to the chemical oxidation of organic contaminants in waste water, the active-oxygen process appears to offer the best potential for technical and economic success. Ultimate disposal of concentrated wastes resulting from the application of physical-chemical separation processes to waste waters has been considered by methods such as (1) wet oxidation, (2) incineration, (3) injection to porous underground formations, (4) placement in natural or man-made underground cavities (Salt cavities, mined or nuclear blast cavities), and (5) disposal in the ocean after pipeline conveyance from point of origin. (Selby-Texas)
W71-02281

EVALUATION OF THE USE OF ACTIVATED CARBONS AND CHEMICAL REGENERANTS IN TREATMENT OF WASTE WATER,
Dow Industrial Service, Cleveland, Ohio.
R. L. Johnson, F. J. Lowes, Jr., R. M. Smith, and T. J. Powers.
Available from NTIS as PB-168 795, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A. Taft Sanitary Engineering Center Report AWTR-11, May 1964. 48 p, 24 fig, 9 tab, 38 ref. FWQA Project 17020-05/64, Contract SAph 76290.

Descriptors: *Waste water treatment, *Activated carbon, Adsorption, Economics, Chemical oxygen demand.
Identifiers: *Hydrogen Peroxide, Regeneration.

By using a continuous-flow, column-type test, the capacities of six activated carbons for the soluble organics in filtered secondary effluent were obtained. Results varied from 7 to 13 grams COD per 100 grams of carbon. Because of the manner in which the test was carried out, only the carbon with the smallest capacity was loaded to the maximum extent possible. The chemical regeneration of exhausted carbon was investigated by use of nine inorganic oxidizing agents: chlorine, bromine, potassium permanganate, sodium dichromate, sodium persulfate, potassium persulfate, sodium peroxide, hydrogen peroxide, and ozone. Only hydrogen peroxide was capable of restoring measureable adsorption capacity after more than two cycles of exhaustion and regeneration. The economic feasibility of chemical regeneration is not promising. (Selby-Texas)
W71-02282

METROPOLITAN PLANNING GUIDELINES, SEWAGE TREATMENT (FACILITIES).
Northeastern Illinois Planning Commission, Chicago, Illinois.

Northeastern Illinois Planning Commission Report, April 1965. 33 p, 9 fig, 9 tab, 14 ref. HUD Grant.

Descriptors: *Sewage treatment, *Waste water treatment, *Urbanization, *Cities, *Municipal wastes, Septic tanks, Illinois, Surveys, Waste water disposal, Sewage, Planning.
Identifiers: *Metropolitan planning, *Chicago.

The findings are summarized of a project designed to: (1) inventory public sewage treatment facilities in the six-county Chicago metropolitan area; and (2) to determine how much new development has taken place inside and outside the areas served by these systems. The data were derived from field surveys, interviews, and unpublished materials. The information is intended for use in the preparation of a comprehensive metropolitan plan. In 1964, approximately 90 percent of the metropolitan area population was served by public sewers, while 10 percent relied on septic tanks and other private equipment. Seven hundred square miles were served by 128 sewer systems and over 3,000 square miles by septic tanks and other facilities. Sewered areas have a gross population density of 8,000 persons per square mile compared with 1,300 for non-sewered areas. Sewage treatment systems are small, serving about one square mile on the average. Three problem areas requiring further study and definition were identified. They are: (1) pollution of surface and ground waters, (2) cost of sewage treatment, and (3) improper size and location of treatment plants for expansion to meet future needs. Figures, charts and tables are included to document the type, capacity, efficiency, age, location and area served by public treatment facilities in Cook, DuPage, Will, Lake, Kane and McHenry counties. (Poertner)
W71-02284

CITY OF SAN DIEGO WATER RECLAMATION STUDY FOR BALBOA PARK AND MISSION BAY PARK.
Boyle Engineering, San Diego, California.

Report to City of San Diego, California, March 1963. 250 p, 40 fig, 50 tab, 52 ref.

Descriptors: *Water reuse, *Irrigation programs, *Groundwater recharge, *Return flow, *Irrigation water, Parks, California, Reclaimed water, Water spreading, Artificial recharge, Saline water intrusion, Irrigation engineering, Irrigation systems, Water supply.
Identifiers: *San Diego.

Benefits are indicated that would result from the conservative re-use of a portion of San Diego's sewage, currently wasted to the ocean; and presents alternative plans for the implementation of a project that would supply the irrigation water requirements of Balboa Park and Mission Bay Park. Each of several alternative plans is economically feasible and it is in the best interests of the City to actively enter the field of water reclamation. It is recommended that: (1) the City pursue a plan of action leading to the design, construction and operation of a water reclamation system with adequate capacity to serve the irrigation requirements of both Balboa Park and Mission Bay Park; (2) areas owned by the City in the vicinity of the designated water reclamation plant sites should be tentatively set aside for water reclamation purposes; and (3) the City should reevaluate the potential value of ground water recharge using reclaimed water in Mission Valley, with the possibility of reactivating the City's Mission Valley well field as a supplemental potable water supply. San Diego presently imports up to 96 percent of its annual water requirements from the Colorado River. The California Water Plan includes provisions for furnishing water to San Diego from Northern California; however, the cost will be from three to five times the present cost of imported water. (Poertner)
W71-02287

MECHANICAL - DRAFT COOLING TOWERS,
Carter Thermal Engineering Ltd.
G. B. Hill.
Chemical and Process Engineering - Heat Transfer Survey, p 33-40, 1969.

Descriptors: *Cooling, *Thermal pollution, Thermal powerplants, *Cooling towers, Cooling water, Heating, Heat budget, Atmosphere, Humidity, Heat transfer, Recirculated water.
Identifiers: Mechanical - Draft cooling.

The use and advantages of mechanical-draught cooling towers is discussed as to theory, construction, operation and suitability. For theoretical evaluations the simplifying approximation of Merkel's total heat theory is used. As to construction, the main emphasis is put on packing where most of the cooling of the water takes place. Splash packing and film packing (in grid or plate arrangements) are the most commonly used. Mechanical-draught cooling towers have a relatively simple construction, although the heat transfer processes which take place within them are extremely complex. Except for ambient air wet bulb temperature, they are virtually independent of atmospheric conditions. They can cool water to temperatures below ambient with low capitol and operational costs in a comparatively small space. To quote for a tower, manufacurers require information on cooling duty, restrictions are on height or weight and noise limitations. (Novotny-Vanderbilt)
W71-02308

HYDROLOGY OF SPRAY-RUNOFF WASTE WATER TREATMENT,
Robert S. Kerr Water Research Center, Ada, Okla.
Richard E. Thomas, James P. Law, Jr., and Curtis C. Harlin, Jr.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR3, Paper 7538, p 289-298, September 1970. 10 p, 4 fig, 4 tab, 15 ref.

Descriptors: *Waste water disposal, *Soil disposal fields, *Overland flow, *Runoff, *Sprinkler irrigation, Evaporation, Evapotranspiration, Water balance, Hydrologic budget, Sewage treatment, Soil water movement, Waste treatment.
Identifiers: Spray-runoff waste water treatment.

Liquid measuring procedures used in a 12-month study of the hydrology of the soil treatment system at Campbell Soup Company's Paris, Texas plant accounted for 93% of the total liquid applied to the soil. The rainfall and waste water applied to the soil system are accounted for as follows: 18% is lost to the atmosphere through evaporative processes; 61% is recovered as runoff; and 21% percolates through the soil. The fraction of the treated waste water recovered as runoff ranges from a low of 30% to a high of 85%. This range in the percent runoff is influenced by climate, soil textural class, and waste water spray schedules. Waste water spray schedules are controlled to partially offset variations in the percent runoff which would normally occur as the result of climatic influences. (Knapp-USGS)
W71-02437

ENGINEERING ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W71-02478

MECHANICS OF CONDENSER WATER DISCHARGE FROM THERMAL POWERPLANTS,
Massachusetts Inst. of Tech., Cambridge, Mass. Dept. of Hydraulic Engineering.
Donald R. F. Harleman.
In: Engineering Aspects of Thermal Pollution, Chapter 5, p 144-164, 1969. 13 fig, 9 ref.

Descriptors: *Thermal powerplants, *Thermal pollution, *Stratification, Mixing.
Identifiers: *Densimetric Froude number.

This paper discusses some of the techniques in the planning and design stage which should be used in considering whether all or a portion of the total waste heat from thermal or nuclear power plants is to be disposed of into an adjacent waterway. Also discussed is the degree of flexibility in controlling conditions in the waterway which is available to the engineer. The interrelationship between the design of the outlet and intake structures for stratification of the condenser water in the adjacent water-way is analyzed, and it is shown that the primary requirement for stratification is an outlet channel designed to have a densimetric Froude number less than unity. The mixing of the heated condenser water by means of a diffuser pipe extending across the river bottom transverse to the direction of the flow is also analyzed. The model experiments of a section of the diffuser pipe of Brown's Ferry's Nuclear powerplant are explained. Some conclusions were: (a) Analytical techniques based on the mechanics of thermally stratified flow can be used in the design of condenser water intake and discharge structures. (b) The designer has a high degree of flexibility in controlling the environmental changes in a waterway receiving thermal discharges from a powerplant. (c) Thermal conditions ranging from stratification of the effluent to complete mixing can be achieved through proper design. (See also W71-02478) (Guerrero-Vanderbilt)
W71-02482

DESIGN AND OPERATION OF COOLING TOWERS,
Public Service Co. of Colorado, Denver.
Charles Waselkow.
In: Engineering Aspects of Thermal Pollution, Chapter 9, p 249-271, 1969.

Descriptors: *Temperature, *Cooling towers, *Cooling water, Thermal pollution, Design criteria, Operation and maintenance.
Identifiers: GEA Air Exchangers-Bochum-West Germany, Wet-bulb temperature, Drift loss, Tower fill, Road-hazard.

One of the truly critical design criteria necessary to a good cooling-tower design is the determination of the design inlet wet-bulb temperature. This temperature should be for the weather conditions encountered during the four summer months of the year. The average steam plant rejects about 5500 to 6000 BTU per Kwhr. Drift loss (0.2%) must be considered in cooling tower design. The sewage effluent used for cooling contains detergents and some organic matter which proved troublesome when the drift spray was carried to the nearby substation by the prevailing winds. One of the remedial measures taken was the installation of additional mist eliminators in the plenum of the cooling tower. The wood deterioration on the Public Service company of Colorado towers is unexplainable. The deterioration of the redwood which is used as towerfill at any one of the three stations bears no resemblance to that at either of the others. One important item of public relations, as it concerns cooling tower operations, is the problem of road hazard. The cooling tower vapor can become a problem on the adjacent streets and highways, if the atmospheric conditions are right and the construction of the tower is not proper. The GEA Air-cooled system is suitable for unusually water scarce areas. It conducts the exhaust steam from the turbine, through large ducting, directly to a header. This minimizes power consumption and prevents freezing problems during cold weather or light load operation. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02486

ECONOMIC CONSIDERATIONS IN THERMAL DISCHARGE TO STREAMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-02488

SUMMARY AND STATUS OF THE ART,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
Frank L. Parker, and Peter A. Krenkel.

In: Engineering Aspects of Thermal Pollution, Chapter 11, p 313-328, 1969.

Descriptors: *Thermal pollution, *Cooling water, Stratified flow, Temperature, Ecology, Fishkill.
Identifiers: Electric generating capacity, Magnetohydrodynamic power generation (MHD), Cooling devices.

Analysis of steam-electric cooling discharges for 1965 indicates an average 13F rise in water temperatures after passing through the condensers. The amount of water withdrawn for this purpose is approximately 42 trillion gallons per year, which is roughly 10% of total flow of water in the U. S. The electric generating industry is doubling in magnitude every 10 years. We can expect that the thermal problems associated with cooling water discharges from steam-electric generating plants will even further exceed the problems from industrial sources, because it appears that industrial plants have, by and large, already reached the maximum economically efficient size. The best efficiencies for present day fossil-fueled plants are about 40% and for light-water reactors about 34%. The MHD systems with single cycles can achieve thermal efficiencies of 50 55%, which possibly could be boosted to 60 to 70% by using a binary cycle. If a binary cycle using a gas turbine is utilized, the thermal pollution problem is avoided entirely. Another possibility for central station generation of electricity is by controlled thermonuclear fusion. Of all the effects of the increased heat to our streams, possibly the most striking is the induction of stratified flow by the discharge of these warmed waters to surface streams, reducing the waste-assimilative capacity of the stream, changing the algal population, and causing chemical reactions to proceed at a faster rate. (See also W71-02478 and W70-05059) (Upadhyaya-Vanderbilt)
W71-02490

BIOLOGICAL ASPECTS OF THERMAL POLLUTION.
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05C.
W71-02491

ENGINEERING ASPECTS, SOURCES, AND MAGNITUDE OF THERMAL POLLUTION,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 05B.
W71-02492

REGIONAL WATER AND SEWERAGE FACILITIES PLAN 1990.
Indian Nations Council of Governments, Tulsa, Okla.

Available from NTIS as PB-194 141, $3.00 in paper copy, $0.95 in microfiche. Report to Indian Nations Council of Governments, April 1970. 186 p. HUD Oklahoma P-117.
Identifiers: *Regional planning, *Oklahoma, *Water supply, Urban areas, *Sewage, Environmental engineering, Demography, Land use, Management methods, Financing, Creek County (Okla), Osage County (Okla), Rogers County (Okla), Tulsa County (Okla), Indian Nations Council of Governments, Capital improvements.

The purposes of the study are: To prepare a regional plan which will aid in the development and maintenance of water supply and waste disposal facilities and thereby assist in the provision of healthful living conditions; to assist to orderly land use change, relationships, and development; and to qualify the region for financial assistance for the construction of water and sewage facilities. The water and sewage plan is based upon guidelines concurrently being developed by the Indian Nations Council of Governments (INCOG).
W71-02611

THE INFLUENCE OF AERATION ON THE COMPOSTING OF POULTRY MANURE-GROUND CORNCOB MIXTURES,
Guelph Univ. (Ontario). Dept. of Microbiology.
R. G. Bell.
Journal of Agricultural Engineering Research, Vol 15, No 1, p 11-16, 1970. 5 fig, 2 tab, 8 ref.

Descriptors: *Farm wastes, *Aeration, *Poultry, Laboratory tests, Odor, Salmonella sp., Temperature, Depth, Microorganisms, Waste water treatment.
Identifiers: *Composting, Corncob mixtures, Canada, Microbial activity.

The influence of the rate of aeration on 1.5m colums of composting mixtures of 2 parts poultry manure and 1 part ground corncob was investigated. The results indicate that the optimum aeration rate for the production of a stable sanitary compost was 4 liters of air/m2/min for every 10 cm. of composting material up to a maximum depth of about 2.4 m. A detailed discussion of the materials, methods and results is presented. (Christenbury-Iowa State)
W71-02683

ENGINEERING ANALYSIS OF CATTLE FEEDLOTS TO REDUCE WATER POLLUTION,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
W. Grub, R. C. Albin, D. M. Wells, and R. Z. Wheaton.
Transactions of the American Society of Agricultural Engineers, Vol 12, 1969, p 490-492, 495. 2 tab, 5 fig, 3 ref.

Descriptors: *Farm wastes, *Cattle, *Water pollution sources, Runoff, Precipitation, Nitrogen, Phosphorus, Biochemical oxygen demand, Slopes, Surfaces, Feeds, Silage, Management, Design, Waste water treatment.
Identifiers: *Feedlots, *Ration composition, Feedlot layout, Waste accumulation.

Incorporating both engineering and biological aspects, this report contains an analysis of data and suggests management and design practices that could reduce materially the pollution contributed by the confined land area where feeder cattle are maintained. The study was conducted in two phases. The first phase was concerned with the waste accumulation on the feedlot surface as influenced by ration. The second phase of the project was concerned with determining the quality of liquid runoff as related to the rations fed to cattle, as related to the time of accumulation of the manure pack. For the first phase, ration composition, its effect on quantity of excretion, and changes in the accumulated wastes are looked at. For the second phase, the effects of precipitation, surfacing material, land slope, depth of waste accumulation, feedlot layout, and ration composition are evaluated. Nitrogen, phosphorus and BOD were used as measures of pollution. (White-Iowa State)
W71-02685

TREATMENT AND DISPOSAL OF ANIMAL WASTES,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
Industrial Water Engineering. Vol 7, No 11, p 14-18, November 1970. 3 fig.

Descriptors: *Farm wastes, Lagoons, Drying, Nutrients, Disposal, Inorganic compounds, Nitrogen, Phosphorus, Nitrification, Denitrification, Confinement pens, Waste water treatment.
Identifiers: Holding tanks, In-house ditches, Oxidation ditches, Separation of wastes, Composting, System.

Due to confinement feeding of livestock it has become doubtful from the profit standpoint to recycle manure by applying it to land. There has been an increase of 120% in the number of cattle of feed in the last 15 years. Laws are being considered which make it mandatory to reduce the pollution potential of livestock waste. The nine most feasible systems for animal waste disposal are discussed. These systems utilize either holding tanks, in-house ditches, separation of wastes, or drying and composting. These systems will remove most of the organic-oxygen-demanding material but not the inorganic nutrients. Land disposal has been effective for disposal of phosphorous. However land disposal for nitrogen may not be adequate. Two techniques for reducing the nitrogen load in animal waste is through ammonia release and the nitrification-denitrification cycle. (Christenbury-Iowa State)
W71-02688

USE OF SOIL TO TREAT ANAEROBIC LAGOON EFFLUENT RENOVATION AS A FUNCTION OF DEPTH AND APPLICATION RATE,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. K. Koelliker, and J. R. Miner.
Transactions of the American Society of Agricultural Engineers, Vol 13, No 4, p 496-499, July-August 1970. 3 fig, 4 tab, 19 ref.

Descriptors: *Denitrification, *Nitrogen, *Irrigation, Farm wastes, Chemical oxygen demand, Lagoons, Nitrates, Nitrites, Ammonia, Bacteria, Treatment, Disposal, Anaerobic conditions, Waste water treatment.
Identifiers: *Nitrogen balance, Nitrobacter, Nitrosomonas, Lagoon effluent, Application rates.

This paper reports the findings from a study where lagoon effluent was applied to soil for final treatment. The active soil profile appears to offer great potential as a final treatment media for partly treated animal wastes. Anaerobic livestock-lagoon effluent sprinkled on grass-covered soil profile reduced the COD, phosphorous, and nitrogen concentrations 95, 99, and 80 percent, respectively in 3 months. Loading range was 13.9 to 30.5 in. of lagoon effluent. Removal of COD was attributed to biological activity and physical filtration in the upper inches of soil. Phosphorus reduction resulted from chemical activity of the clay fraction near the soil surface. Nitrogen reduction was attributed primarily to dentrification in the soil profile. It was recommended that if nitrogen reduction is a goal in waste water disposal, a rather wet schedule should be followed. The applied waste water should contain some organic load so that a substrate will be provided for the denitrifying bacteria. (Christenbury-Iowa State)
W71-02689

BIO-OXIDATION OF SWINE WASTE BY THE ACTIVATED-SLUDGE PROCESS,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
Ronald E. Hermanson, Thamon E. Hazen, and Howard P. Johnson.
Transactions of the American Society of Agricultural Engineers, Vol 12, No 3, 1969, p 342-348. 5 fig, 1 tab, 19 ref.

Descriptors: *Farm wastes, *Hogs, *Activated sludge, *Model studies, Anaerobic conditions, Farm lagoon, Regression analysis, Least squares method, Biochemical oxygen demand, Aeration, Settling basins, Nitrogen, Temperature, Effluent, Dissolved oxygen, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Extended aeration, BOD-reduction efficiency, Mixed liquor, Aeration tank, Suspended solids.

The purpose of this research was to investigate the extended-aeration, activated-sludge process on swine waste treatment. Two objectives were: (1) to develop a mathematical model for the BOD-reduction efficiency of the process, and (2) to verify the model and evaluate its coefficients by conducting experiments with a laboratory-scale plant. The components of the activated-sludge treatment plant were as follows: (1) an aeration tank; (2) an

aeration system; (3) a sedimentation tank; and (4) a mechanism for returning settled activated sludge to the aeration tank. The experimental model was comprised of an aeration tank and a sedimentation tank made of Plexiglas, with two galvanized sheet metal sedimentation tanks as alternates. Three capacities were required in the sedimentation section to provide suitable detention times over the range of flow rates used. The following conclusions resulted from this research. (1) Effluent from an anaerobic lagoon is sufficiently constant to be a practical influent substrate for model studies. (2) Excessive solids loss because of denitrification can be avoided by proper design of the sedimentation tank, provided the flow rate does not vary widely. (3) The mathematical model satisfactorily predicted the BOD-reduction efficiency of an extended-aeration, activated-sludge plant, as evidenced by the reasonably high multiple r2 (0.92) and the low standard error (2.6 percent) of the experimental regression equation. (4) The aeration tank of an extended-aeration activated-sludge plant for the treatment of the effluent from an anaerobic swine lagoon designed according to the equation developed. (White-Iowa State)
W71-02693

UNDER-CAGE MANURE DRYING SYSTEM SOLVES ODOR PROBLEMS,
Cloisterdale Farms, Ephrata, Pa.
Glenn H. Herr.
Farm Service Bulletin, July-August, 1970. Poultry Digest, Vol 29, No 344, p 476-479, October 1970. 4 fig.

Descriptors: *Farm wastes, *Poultry, *Odors, *Aeration, *Disposal, Economics, Aerobic conditions, Forced drying, Liquid wastes, Drying, Lagoons, Anaerobic bacteria, Costs, Waste water treatment.
Identifiers: *Stirring, Odor-causing bacteria, Semi-dry manure.

This paper deals with the problems and their solutions encountered by a commercial poultry farm with odors and waste management. The various systems that were tried unsuccessfully are discussed. Their solution was one developed by Dr. Glenn Bressler and co-workers at Pennsylvania State University for drying the manure. The system employs a stirring device and forced air to keep the manure aerobic. The manure is dried to one-third its original weight which has eliminated many of their disposal problems. The cost of the system is discussed. (Christenbury-Iowa State)
W71-02696

POULTRY MANURE LAGOON DESIGN,
California Univ., Davis. Agricultural Extension Service.
Robert A. Parsons, Fred Price, and W. C. Fairbank.
Poultry Digest, Vol 29, No 344, p 485-488, October 1970. 6 fig.

Descriptors: *Farm wastes, *Poultry, *Lagoons, *Design criteria, *Odor, Cleaning, Recirculated water, Costs, Anaerobic conditions, Anaerobic bacteris, Aerobic conditions, Aerobic bacteria, Aeration, Waste water treatment.
Identifiers: *Flushing gutter, Macerated chicken carcasses, Floating debris, V-trough, Washout system, Overload, Malfunctions, Gutter design, Thiopedea roses.

This paper deals with lagoon design criteria for poultry manure. A lagoon is a satisfactory means of poultry manure disposal. The lagoon should be used only in rural areas that are tolerant of varied but dilute odors of farm production. Overloading is about the only cause of lagoon malfunction. Size requirements, construction, flushing system, and lagoon operation are discussed. (Christenbury-Iowa State)
W71-02700

ANIMAL WASTE MANAGEMENT.
Cornell Univ., Ithaca, N.Y.

R. C. Loehr, Editor. In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, January 13-15, 1969. 414 p.

Descriptors: *Farm wastes, *Hogs, *Cattle, *Water pollution, *Air pollution, Soil contamination, Rates of application, Poultry, Sheep, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Hydrogen ion concentration, Oxidation Lagoons, Lagoons, Aeration, Soils, Moisture content, Fertilizers, Nitrogen, Phosphorus, Potash, Economics, Legal aspects, Legislation, Water quality act, Water table, Odors, Rotors, Aerobic conditions, Anaerobic conditions, Digestion, Antibiotics, Irrigation, Oxygen, Rotations, Hydrology, *Waste water treatment.
Identifiers: *Oxidation ditch, Land disposal, *Feedlots, *Confinement, Population equivalent, Slatted floors, Decomposition.

The increase in high density confined animal production operations in the past decade has led to a number of environmental quality problems, such as air and water pollution. The 1969 Conference attempted to bring knowledgeable individuals from many disciplines together to mutually discuss various aspects and potential solutions to the animal waste management problem. Forty-six papers, reports, and speeches are presented in the proceedings. Such diverse topics as hydrology, economics, odor measurement, lagooning, aerobic digestion, and land disposal are presented. Research and studies in many fields are reported. (White-Iowa State)
W71-02701

EFFECTS OF WATER QUALITY STANDARDS ON THE REQUIREMENTS FOR TREATMENT OF ANIMAL WASTES,
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W71-02704

THEORY AND FUTURE OUTLOOK OF ANIMAL WASTE TREATMENT IN CANADA AND THE UNITED STATES,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
P. H. Jones.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 23-36. 2 tab, 27 ref.

Descriptors: *Farm wastes, *Biochemical oxygen demand, *Biological treatment, *Oxygen, Water pollution, Nitrogen, Odors, Carbon, Waste water treatment, Aeration, Aerobic treatment, Anaerobic digestion.
Identifiers: Pollution potential, Waste characteristics, Integrated farming, Aerobic composting.

This paper presents some of today's theories on waste treatment and their effectiveness, both socially and physically. The paper tells of the pollution potential and characteristics of animal waste, as well as some of the waste treatment objectives. Theoretical formulas are presented for the introduction of oxygen into an aqueous system, and the reduction of BOD. Potential solutions to the waste treatment problem are listed and summarized as follows: integrated farming, anaerobic holding, aerobic systems, complete treatment, anaerobic digestion, drying and incineration, and aerobic composting. Research needs are given, as well as a look to the future for what may be possible. (White-Iowa State)
W71-02706

DESIGN PARAMETERS FOR THE STABILIZATION OF HIGHLY ORGANIC MANURE SLURRIES BY AERATION,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
Albert F. Vickers, and Emil J. Genetelli.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 37-49. 7 fig, 6 tab, 11 ref.

Descriptors: *Farm wastes, *Poultry, *Aerobic treatment, *Biochemical oxygen demand, Dissolved oxygen odor, Waste water treatment.
Identifiers: Aerobic stabilization, Manure slurry, Ultimate disposal, Loading parameter, Suspended solids.

It has been determined in this research that aerobic stabilization basins are not suitable for the complete treatment of slurries of poultry manure. However, the aerobic stabilization basins do provide satisfactory pretreatment prior to ultimate disposal. This treatment provides sufficient stabilization of the manure to eliminate nuisance problems when ultimately disposed of on land. The critical loading parameter determined in this bench scale system is a volume loading of 60 cubic feet of aeration basin per pound of applied BOD in the manure slurry. The average BOD reduction in the unsettled effluent was 87% with an average solids destruction of 53%. Foaming difficulties were encountered after the critical loading parameter determined was exceeded. (White-Iowa State)
W71-02707

SWINE WASTES, CHARACTERIZATION AND ANAEROBIC DIGESTION,
Kansas Agricultural Experiment Station, Manhattan.
Lawrence A. Schmid, and Ralph I. Lipper.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 50-57. 4 tab, 2 fig, 3 ref.

Descriptors: *Farm wastes, *Anaerobic digestion, Swine, Biochemical oxygen demand, Chemical oxygen demand, Methane, Odor, Waste water treatment.
Identifiers: *Digester, Waste digestion, Feed ration.

Laboratory and field tests were undertaken to show the effectiveness of anaerobic digestion as a possible solution to swine waste treatment. The following conclusions are made from the study: (1) The waste characteristics can be related to pounds of waste per unit pound of live weight. (2) If organic removal is the desired objective, it can best be done by solids removal from the fresh wastes resulting in COD reductions of 90%. (3) Mixing is required in the anaerobic digestion phase to disperse the fresh waste. (4) Normally, the efficiency of anaerobic treatment can be increased by increasing the solids retention time. (5) Results have shown that conventional anaerobic digestion cannot be practiced on raw undiluted hog wastes which include the urine. (6) Digestion only for liquifaction does not require the close environmental control required to stimulate growth of methane bacteria. (7) Design for the objective of waste liquifaction for the purpose of reuse as flushing water, ultimate disposal on land, and ease of handling can be one answer to the problem of handling and treatment of wastes from confinement feeding of swine. (White-Iowa State)
W71-02708

AEROBIC DECOMPOSITION OF SOLID WASTES FROM CATTLE FEEDLOTS,
Texas Technological Coll., Lubbock. Dept. of Civil Engineering.
D. M. Wells, R. C. Albin, W. Grub, and R. Z. Wheaton.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 58-62. 4 fig.

Descriptors: *Farm wastes, *Moisture content, Cattle, Temperature, Nitrogen, Phosphorus, Waste water treatment.
Identifiers: *Aerobic stabilization, *Composting process.

This is a progress report on research being conducted on the aerobic stabilization of solid beef feedlot wastes and is concerned with the composting process and with the effect of feed, management, and climate on waste stabilization. Two general areas were reported in the paper, one concerned with composting in open air piles and the other with composting in a specially built drum type digester. Forty per cent reductions in volume and 20% losses in dry matter were noted. The most rapid rate of stabilization seemingly takes place during the first few days of the process, with a steady decrease in the rate of stabilization occurring with time. (White-Iowa State)
W71-02709

ANALYSIS FOR OXYGEN TRANSFER COEFFICIENTS IN ROTOR AERATION SYSTEMS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
John J. Kolega, Gordon L. Nelson, and Quintin B. Graves.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 63-75. 9 fig, 4 tab, 13 ref.

Descriptors: *Farm wastes, *Equations, Oxygen, Dissolved oxygen, Oxygenation, *Model studies, Waste water treatment.
Identifiers: *Rotor aerator, *Oxidation ditch, Oxygen transfer.

The laboratory method described presents a technique for use in the engineering design and analysis of a horizontal rotor aerator system in livestock waste management. This procedure can be used to obtain quantitative prediction equations to estimate the oxygen transfer coefficients for a selected range of operating conditions. Once the prediction equation for a given system is developed, it can be further used to evaluate new applications provided the parameters fall within the range of the predicted equation developed. An equation for estimating the oxygen transfer coefficients per revolution of rotor was obtained with a model rotor aerator using distilled water as the liquid. Rotor aerator performance curves illustrating how the prediction equation can be used in livestock waste system design and management were also developed. (White-Iowa State)
W71-02710

AEROBIC STORAGE OF DAIRY CATTLE MANURE,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
Don E. Bloodgood, and C. M. Robson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 76-80. 2 tab, 1 fig, 4 ref.

Descriptors: *Farm wastes, Cattle, Aeration, Temperature, Odor, Chemical oxygen demand, Waste water treatment.
Identifiers: Dairy cattle, Loading rates, Kjeldahl nitrogen, Degradation, Volatile solids.

Laboratory tests with seven liter, aerated containers were performed in 4C and 24C rooms. Loading rate of 60, 80, 100, and 120 grams of wet raw dairy manure per day were used at both temperatures. Conclusions were made from the results of the experiment as follows. (1) The amount of leading does not influence the degree of degradation that takes place. (2) The tests indicate a decrease in volatile solids of 20 per cent at 4C and 42 per cent at 24C. (3) Appreciable amounts of material with a COD are removed in the aerobic storage process. (4) The Kjeldahl nitrogen concentration of material remaining after aerobic storage is higher after the storage period. (5) Foaming is a real problem in the aerobic storage of manure from dairy cattle. (6) Aerobic storage of manure from dairy cattle has promise of minimizing the odor problem encountered in the spreading of unaerated material after storage. (White-Iowa State)
W71-02711

AEROBIC DIGESTION OF DILUTED ANIMAL MANURE IN CLOSED SYSTEMS - TEMPORARY EXPEDIENT OR LONG RANGE SOLUTION,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
J. T. Clayton, and T. H. Feng.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 81-87. 6 fig, 1 ref.

Descriptors: *Farm wastes, *Aerobic treatment, *Anaerobic digestion, *Effluents, Cattle, Biochemical oxygen demand, Nitrates, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Sedimentation tanks, *Degradation, Volatile solids.

The pilot scale manure treatment system studied was an adapted composite of two aerobic-anaerobic dairy manure treatment systems. It was designed to process the waste of one mature dairy cow, together with the water necessary to flush the manure from the barn. The system consisted of a 2000 gallon primary sedimentation tank, a 1000 gallon aeration tank, and a 200 gallon final sedimentation tank. The effluent was collected and analyzed at three different points in the closed system. Graphs of total solids, volatile solids, pH, BOD, and nitrate content versus time are given for the three effluent collection points. The overall objective was to design a system the effluent from which could be used as a flushing and transport medium for subsequent cleanings of a dairy cow housing facility, or be discharged into a water course. (White-Iowa State)
W71-02712

INFLUENCE OF CHEMICAL TREATMENTS UPON DIGESTIBILITY OF RUMINANT FECES,
Agricultural Research Service, Beltsville, Md. Animal Husbandry Research Div.
L. W. Smith, H. K. Goering, and C. H. Gordon.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 88-97. 10 tab, 11 ref.

Descriptors: *Farm wastes, *Cattle, *Digestion, Sheep, Orchardgrass, Alfalfa, Ruminants, Waste water treatment.
Identifiers: Sodium hydroxide, Sodium peroxide, In vitro fermentation, Chemical treatment.

Sodium hydroxide and sodium peroxide treatment of orchardgrass and alfalfa cow feces resulted in large decreases in the cell wall (CW), cellulose, hemicellulose, and lignin contents. Treatment with sodium chlorite changed composition little except for a large reduction in lignin content. True CW digestibility was increased several fold by each treatment as measured by an in vitro fermentation technique. Corn silage rations containing 25% of the total dry matter (DM) as either untreated or 3% sodium peroxide treated orchardgrass feces were consumed equally well as an all corn silage ration by sheep. Lower intake was observed for a corn silage ration which contained 50% similarly treated feces also on a dry matter basis. Digestibility coefficients for the various components of the feces portion of the rations were calculated by difference. Addition of 3% sodium peroxide to feces increased average DM, 29; nitrogen, 25; CW, 55; cellulose, 41; and hemicellulose, 90 digestibility units over that of the untreated feces. Neither concentration nor molar ratios of ruminal volatile fatty acids changed due to the inclusion of treated or untreated feces in rations for sheep. (White-Iowa State)
W71-02713

THE VALUE OF HYDROLYZED AND DRIED POULTRY WASTE AS A FEED FOR RUMINANT ANIMALS,
Pennsylvania State Univ., University Park.
T. A. Long, J. W. Bratzler, and D. E. H. Frear.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 98-104. 12 tab.

Descriptors: *Farm wastes, *Feeds, *Nitrogen, Poultry, Cattle, Sheep, Waste water treatment.
Identifiers: *Hydrolyzed poultry waste, Rations, Feedlot performance, Digestion coefficient, Carcass characteristics.

Information was presented concerning the value of heat treated poultry waste as a source of nutrient for ruminant animals. In a metabolism trial, whethers were fed a semi-purified ration in which the nitrogen was supplied by hydrolized poultry waste, cooked poultry waste, or soybean oil meal. The digestion coefficients for crude protein differed significantly (PA.05) between all rations. Nitrogen excreted in the feces was significantly lower for the soybean oil meal ration than for the poultry waste ration. No other significant differences were observed. It was found in a fattening trial with steers that rate of gain, feed efficiency, and carcass grade were not significantly different for beef steers fed rations in which the supplemental nitrogen was supplied as soy bean oil meal, hydrolized poultry waste or dried poultry waste. Rate of gain was higher (PA.05) for the steers fed the ration containing urea. The treated poultry waste rations were readily consumed by the steers and no undesirable effect on carcass characteristics were found. (White-Iowa State)
W71-02714

CATTLE MANURE: RE-USE THROUGH WASTELAGE FEEDING,
Alabama Agricultural Experiment Station, Auburn.
W. Brady Anthony.
In: Animal waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 105-113. 9 tab, 1 fig, 10 ref.

Descriptors: *Farm wastes, *Cattle, Feeds, Performances, Waste water treatment.
Identifiers: *Wastelage, Yeast fermentation.

Manure collected daily from a concrete floor of a pen housing steers was blended with a fattening feed in the ratio of 2:3. The wastelage system was developed for more flexibility. Wastelage is the combining of fresh manure with ground grass hay in the ratio of 57:43 with storage in a silo until fed. Five conclusions were drawn from the study. (a) Fresh feedlot manure can be mixed with concentrate and fed successfully to cattle with a considerable saving in feed used per unit of beef produced. (b) Wastelage represents a flexible system of removing manure daily, blending it with hay, and storing as silage. (c) Elimination of pollution from steer feedlots can be obtained through use of the wastelage plan. (d) Yeast can be produced on fluidized and aerated manure. About 68% of manure dry matter appears recoverable in the yeast fermentation product. (e) Feedlot manure properly handled is a valuable product for conversion to an animal feed. (White-Iowa State)
W71-02715

SPECIFICATIONS FOR EQUIPMENT FOR LIQUID MANURE DISPOSAL BY THE PLOW-FURROW-COVER METHOD,
Rutgers - The State Univ., New Brnuswick, N.J. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W71-02716

USE OF POULTRY MANURE FOR CORRECTION OF Zn and Fe DEFICIENCIES IN PLANTS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.

B. F. Miller, W. L. Lindsay, and A. A. Parso.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 120-123. 2 tab, 6 ref.

Descriptors: *Farm wastes, *Fertilizers, Poultry, Iron, *Corn, Waste water treatment.
Identifiers: *Micronutrient deficiency, Zinc.

A greenhouse study was conducted with corn on a soil deficient in available Zn and Fe. Fifteen fertilizer combinations including N,P, Zn, Fe, poultry manure and poultry manure ash were used. Adequate K was supplied by the soil. The results of this study are interpreted as showing that poultry manure is beneficial for the correction of Zn and Fe deficiencies. This benefit is supplementary to its value as an NPK fertilizer. Furthermore, the organic fraction of poultry manure is important in rendering Zn and Fe more available to plants. This beneficial effect is greater in the case of Fe than Zn, but it is significant in both cases. The findings of this study support the hypothesis that manure and other organic wastes may either supply or give rise to natural chelating agents that aid in the solubilization of insoluble micronutrient elements in soil and thereby render them more available to plants. (White-Iowa State)
W71-02717

THE NITROGEN PROBLEM IN THE LAND DISPOSAL OF LIQUID MANURE,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W71-02718

STATUS REPORT ON WATER POLLUTION CONTROL FACILITIES FOR FARM ANIMAL WASTES IN THE PROVINCE OF ONTARIO,
A. R. Townshend, K. A. Reichert, and J. H. Nodwell.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 131-149. 14 tab, 5 fig, 9 ref.

Descriptors: *Farm wastes, *Water pollution control, Cattle, Hogs, Poultry, Lagoons, Waste water treatment.
Identifiers: *Population equivalent, *Confinement housing, Pollution potential, Concentrations, Land disposal, Oxidation ditch.

Farm animal waste problems of the agricultural industry in Ontario are concentrated on the liquid manure water pollution control facilities presently serving swine, beef cattle, dairy cattle, and poultry confinement housing operations. It is concluded that based on present technology and economics, the approach to animal waste disposal in Ontario for the forseeable future should continue to be one of storage and land disposal rather than treatment and effluent discharge to water courses. The status report estimates the pollution potential of farm animal wastes; outlines the present methods of handling liquid manure from confinement operations; tabulates animal waste characteristics, loadings, and population equivalents; gives field data and experiences on typical water pollution control facilities; and concludes with guidelines on the selection, design, and operation of farm waste systems. (White-Iowa State)
W71-02719

DISPOSAL OF DAIRY CATTLE WASTES BY AERATED LAGOONS AND IRRIGATION,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
A. C. Dale, J. R. Ogilvie, A. C. Chang, and M. P. Douglas.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 150-159. 11 fig.

Descriptors: *Farm wastes, *Oxidation lagoon, *Sprinkler irrigation, Biochemical oxygen demand, Chemical oxidation demand, Oxidation-reduction potential, Odor, Irrigation, Waste water treatment.
Identifiers: Dairy cattle.

The system studied the aerobic type using a lagoon for storage and treatment but relying solely on sunlight and algae for oxygen. A mechanical surface aerator was used to supply oxygen and for mixing. An overhead sprinkler irrigation system was used in conjunction with the treatment lagoon. The liquid was applied to cropland (grassland) beside the lagoon. Perameters measured included BOD, COD, total solids, volatile solids, pH, and total gallons of influent and effluent; temperature, DO, pH and oxidation-reduction potential of the mixed liquor; distribution of effluent by irrigation; and odor associated with the area. Tentative conclusions were reached as a result of work to date: (a) The system is odorless. (b) The system provides a place to dispose of wastes at all times. (c) Nutrients are saved and are returned to the land. (d) With proper operation, runoff into streams and ditches is minimized. (e) Pollutional characteristics of all wastes are greatly lowered. (f) Cost of installation and operation do not appear to be excessive. (g) A relatively small amount of labor is required. (White-Iowa State)
W71-02720

FIELD TESTS OF OXIDATION DITCHES IN CONFINEMENT SWINE BUILDINGS,
Illinois Univ., Urbana. Dept. of Agricultural Engineering.
Don D. Jones, Donald L. Day, and James G. Converse.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 160-171. 15 fig, 1 ref.

Descriptors: *Farm wastes, *Hogs, *Rotors, Oxygen demand, Biochemical oxygen demand, Chemical oxygen demand, Waste water treatment.
Identifiers: *Oxidation ditch, *Confinement buildings, Total solids, Volatile solids.

Tests at the University of Illinois were conducted using two buildings with oxidation ditches. Detention time, rotor speed, rotor immersion, and loading rates were varied. Oxygen demand, solids, BOD and COD were measured periodically and plotted by a digital computer. Problems with foaming and ammonia odor were encountered, but solved by altering the liquid depth and rotor immersion. Apparently the velocity of the waste in the ditch seems to be the controlling factor in oxidation ditch operation. Adequate velocity and oxygenation occurred when the immersion of the aeration rotor into the waste was equal to approximately one-third of the liquid depth. A liquid volume of 200 to 250 cubic feet of ditch volume per foot of rotor length served to maintain a velocity that prevented solids from settling in the ditch. With sufficient gutter volume to give 50 days detention time, the aerobic digestion process can reduce the 5-day BOD of hog waste from approximately 35,000 mg/l to around 3000 mg/l. (White-Iowa State)
W71-02721

STUDY OF THE USE OF THE OXIDATION DITCH TO STABILIZE BEEF ANIMAL MANURES IN COLD CLIMATE,
Minnesota Univ., Minneapolis.
J. A. Moore, R. E. Larson, and E. R. Allred.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 172-177. 3 fig.

Descriptors: *Farm wastes, *Climates, *Air temperature, Biochemical oxygen demand, Chemical oxygen demand, Cattle, Rotors, Stabilization, Waste water treatment.
Identifiers: *Oxidation ditch, *Slatted floor.

When loaded at the rate of one animal per 210 cu. ft. of liquid it appears that the oxidation ditch can be operated in cold weather. From results of this trial it can be projected that the oxidation ditch can successfully function to contain and provide minimal treatment to beef cattle wastes in cold climate with the pollutional threat stored until spring. At that time the liquid which is too polluted to be discharged to a waterway might be applied to a receptive soil media for further treatment. The results of a summer operation at a loading rate of one animal per 140 cu. ft. of liquid, indicate that the system achieved an 87% reduction of 5 day BOD. Additional treatment will be required however, because the BOD of the slurry was 22,000 mg/l at the end of the test period. Results indicate that the oxidation ditch system can be used to treat beef waste in climates which experience extended periods of sub-freezing temperatures, although digestion is minimal at these temperatures. Some foaming resulted but was not a limiting parameter. Normal operation has resulted in a low odor level. Sludge buildup was not a problem with an annual cleanout cycle. (White-Iowa State)
W71-02722

CHANGES IN COMPOSITION OF CONTINUOUSLY AERATED POULTRY MANURE WITH SPECIAL REFERENCE TO NITROGEN,
Guelph Univ. (Ontario).
J. B. Edwards, and J. B. Robinson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 178-184. 5 fig, 2 tab, 8 ref.

Descriptors: *Farm wastes, *Nitrogen, Poultry, Aeration, Nitrification, Denitrification, Oxidation-reduction potential, Rotors, Waste water treatment.
Identifiers: *Nitrogen loss, *Oxidation ditch.

The objectives were (a) to study the nitrogen transformation in continuously aerated liquid manure, (b) to determine the most efficient means of eliminating nitrogen from waste (for situations in which sufficient land is not available to meet guidelines for pollution control) and (c) to determine what steps must be taken to prevent losses of nitrogen from liquid manure (for situations in which crop utilization is an integral part of the operation, and sufficient land is available). The study was limited to liquid poultry manure and this report deals, in a preliminary way, with changes in nitrogen components in such waste continuously aerated in both laboratory units and in an oxidation ditch. The results show that the mechanical rotor as operated was not capable of maintaining strictly aerobic conditions in the ditches for more than a few days. In spite of this, odor did not become a problem. From the limited data obtained, the oxidation ditch appears to be a useful device for controlling the ultimate nitrogen content of the manure before land utilization. By encouraging the nitrification-denitrification sequence nitrogen can be removed and, presumably, by inhibiting nitrification, nitrogen could be conserved. (White-Iowa State)
W71-02723

FARM WASTE DISPOSAL FIELD STUDIES UTILIZING A MODIFIED PASVEE OXIDATION DITCH, SETTLING TANK, LAGOON SYSTEM,
Farmland Industries, Inc.
Gerald R. Foree, and Richard A. O'Dell.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 185-192. 7 tab, 6 fig, 8 ref.

Descriptors: *Farm wastes, *Hogs, *Lagoons, *Efficiencies, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Hydrogen-ion concentration, Waste water treatment.
Identifiers: *Oxidation ditch, *Settling tank, Total solids, Fixed solids, Volatile solids.

The system studied was two buildings, capable of holding 10 sows and litters apiece, located over oxidation ditches. The ditches emptied into a settling tank which in turn emptied into a lagoon. Measurements of dissolved oxygen, temperature, pH, BOD, COD, various solids determinations, various nitrogen determinations, and bacterial quantitation were taken and presented in 7 tables and 5 graphs. The data indicated that the oxidation ditch itself operated at approximately 50% efficiency under optimum operating conditions. The total system

ditch, settling tank and lagoon appeared to operate between 70 and 90 per cent efficiency, depending on the research parameter studied. (White-Iowa State)
W71-02724

CATTLE FEEDLOT WATER QUALITY HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05G.
W71-02726

TREATMENT OF WASTES FROM BEEF CATTLE FEEDLOTS - FIELD RESULTS,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 225-241. 8 fig, 4 ref.

Descriptors: *Farm wastes, *Cattle, *Anaerobic conditions, Alkalinity, Biochemical oxygen demand, Chemical oxygen demand, Ammonia, Nitrates, Nitrites, Rainfall, Water pollution, Digestion, Waste water treatment.
Identifiers: *Feedlots, *Aerobic stabilization, *Polishing unit, *Intermittent loading, Volatile acids, Volatile solids, Total solids, Turbine blower.

Results are presented from a field demonstration study to investigate an anaerobic-aerobic treatment system for beef cattle feedlot waste water, some of the management aspects of such a system are discussed, and data are presented on the quality of runoff from beef cattle feedlots. The demonstration system consisted of a 40,000 gallon anaerobic unit which overflowed into a 15,000 gallon aerobic unit. Aerobic stabilization was accomplished by means of a turbine blower and a simple diffuser system. The effluent from the aeration unit flowed to a polishing unit which provided for separation of the residual solids. The ability of this system to reduce the pollution from feedlot runoff was demonstrated. The system was able to absorb shock loads of waste that were periodically scraped into the anaerobic unit. The results of the study showed that frequent addition of wastes to the system, frequent mixing of the anaerobic unit, and removal of only a portion of the contents of the anaerobic unit materially assisted the satisfactory performance of the unit and the maintenance of equilibrium conditions. The individual units have been shown to function adequately with a minimum of attention. Further treatment would be required before the effluent could be released to a receiving stream. (White-Iowa State)
W71-02728

MANURE CONSERVATION,
HUPSI Corp., Wabash, Ind.
Robert M. LaSalle, Jr., and Mark Launder.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 245-248. 1 fig.

Descriptors: *Farm wastes, *Fertilizers, Poultry, Potash, Air-conditioning, Gross profit, Costs, Dehydration, Waste water treatment.
Identifiers: *Phosphoric acid, Anhydrous ammonia, *Manure conservation.

Tests were conducted in the fall and winter of 1967 on a proposed system of manure conservation. Poultry manure was stabilized and used as a fertilizer rather than going through a bio-degradation process. Troughs were placed under the chickens and a weak phosphoric acid solution flowed by gravity under subsequently lower cage levels and finally into a sump from which it was pumped to the upper most levels. Droppings were immediately stabilized, denatured, and deodorized upon falling into the solution. Additional treatment consists of buffering to reduce the acidity to the proper value for fertilizer and adding potash to increase the potash values to that commensurate with the nitrogen and phosphate analysis for commercial use. Buffering can be done with anhydrous ammonia or potash so that either the nitrogen or potash values are augmented. By these means control is available to bring the final product to any desired fertilizer analysis. An analysis of 10-3-2 can command a price of $61.60 per ton with a gross profit of $14.50 if dehydration is used. By refrigerating the solution flowing under the chickens, the chicken house is completely and perfectly air conditioned. (White-Iowa State)
W71-02730

CAGED LAYER PERFORMANCE IN PENS WITH OXIDATION DITCHES AND LIQUID MANURE STORAGE TANKS,
Guelph Univ., (Ontario). Dept. of Poultry Science.
J. P. Walker, and J. Pos.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 249-253. 3 fig, 1 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, *Performance, Anaerobic conditions, Aerobic conditions, Mortality, Odor, Biochemical oxygen demand, Waste water treatment.
Identifiers: *Oxidation ditch, Feed conversion, Aerator, Population equivalent, Egg production.

The hen housed egg production, feed conversion and mortality performance of caged layers in a pen with oxidation ditches was slightly better than that of caged layers in pens with liquid manure, storage tanks. The odor in the pens with oxidation ditches was less offensive than in the pens with anaerobic storage. Aerators, however, should be installed outside the pen area. The tank design is very important from the standpoint of liquid circulation, and clean-out. A drain to a sump hole for cleaning is essential. The foaming problem, while controlled by commercial anti-foaming agents, limits the practical application of aerators for poultry until a more economical means is found. Cage systems that do not need dropping boards (eg. full stair-steps) should be used; this would eliminate shock loading, reduce odors and labor requirements. (White-Iowa State)
W71-02731

PROBLEMS AND PRACTICES IN SOME SYSTEMS OF MANURE HANDLING IN NORTHERN EUROPE,
Cornell Univ., Ithaca, N.Y. Dept. of Animal Science.
A. M. Meek, W. G. Merrill, and R. A. Pierce.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 254-259. 4 fig, 6 ref.

Descriptors: *Farm wastes, *Cattle, *Storage, Odor, Disposal, Waste water treatment.
Identifiers: *Dairy cattle, *Handling system, Slatted floors, Poisonous gases, Agitation, Free-stall housing.

Dairy manure handling systems and operations were visited in Scotland, England, Denmark and Sweden. The various types of systems consisted of under-building and outside-underground storage facilities with some type of pump or shuttle agitation system. Many incorporated steel or concrete slatted floors with manure storage pits underneath. Problems of odor and poisonous gases were discussed. A list of 15 safety points for the prevention of gas problems was given. Symptoms of gas poisoning were also listed. (White-Iowa State)
W71-02732

MEASUREMENT OF THE ODOR STRENGTH OF ANIMAL MANURES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-02733

MICROBIOLOGICAL AND CHEMICAL CHANGES IN POULTRY MANURE ASSOCIATED WITH DECOMPOSITION AND ODOR GENERATION,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
William E. Burnett, and Norman C. Dondero.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 271-291. 18 fig, 1 tab, 5 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, Aerobic bacteria, Anaerobic bacteria, Ammonia, Hydrogen sulfide, Sulfur bacteria, Waste water treatment.
Identifiers: *Olfactory threshold test, *Odor Intensity Index, *Threshold odor numbers, Uric acid, Odor panel, Volatile organic acids.

Changes in the microbial and chemical composition of batch lots of 'dry' and 'liquid' poultry manure during decomposition were related to the production of offensive odors. The decomposition of uric acid by both aerobic and anaerobic uricolytic bacteria appeared to be related to the formation of significant quantities of ammonia. The number of sulfate-reducing bacteria, including Desulfovibrio species, increased during the course of decomposition of liquid poultry manure. These organisms were implicated as producers of some of the hydrogen sulfide in liquid poultry waste. There were apparent correlations between an increase in odor intensity of liquid manure with increased storage time and the concentrations of volatile organic acids, ammonia, and sulfides. (Miner-Iowa State)
W71-02734

CHEMICAL ASPECTS OF ODOR REMOVAL IN SOIL SYSTEMS,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. C. Gumerman, and D. A. Carlson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 292-302. 6 fig, 1 tab, 7 ref.

Descriptors: *Farm wastes, *Odor, *Hydrogen sulfide, Soil moisture, Waste water treatment.
Identifiers: *Soil filter, *Removal mechanism, Detention time, Reaction temperature.

On the basis of the data presented, it was found possible to postulate mechanisms which describe the removal of hydrogen sulfide species on soil in both wet and dry conditions. Removal of high concentrations of hydrogen sulfide from moving air streams is performed much more efficiently by dry soil than wet. Inter-related parameters which influence the removal of hydrogen sulfide by dry sterile soil are detention time, reaction temperature, amount of hydrogen sulfide entering, concentration of hydrogen sulfide, and the total flow rate. A method of design optimization is presented which determines for a given concentration and influent gas temperature, the total flow rate at which the maximum removal of hydrogen sulfide per unit time results. It is felt this design optimization method should be restricted to air streams containing only hydrogen sulfide, until further research delineates the removal mechanism for other odorous gases. (White-Iowa State)
W71-02735

POULTRY HOUSE DUST, ODOR AND THEIR MECHANICAL REMOVAL,
Harry J. Eby, and G. B. Willson.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 303-309. 1 tab, 5 fig, 6 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, *Dusts, Filters, Waste treatment.
Identifiers: Foam pad filters, Clogging.

Tests of plastic foam pad filters as a method of trapping the odor carrying dusts from a poultry

house exhaust fan air stream have shown that foam pads of 10 to 40 pores per square inch are effective. However, the tests show that such pads become clogged with dust in about 6 to 9 hours of operation. Vacuum cleaning and water washing methods of cleaning for continued use were ineffective and the high initial cost of the foam filter material were deemed to make this method impractical. Tests of a device in which the exhaust air is deflected tangentially across a 1/2 inch mesh screen showed that such methods would remove at least a portion of the odor carrying dust. These were also deemed impractical in that the filter ability would appear to be a direct function of the relative humidity and as such would be the least efficient when low relative humidity within the poultry house would make the dust problem the greatest. Other methods of possible filtering techniques were discussed. (White-Iowa State)
W71-02736

CHARACTERISTICS OF AQUEOUS SOLUTIONS OF CATTLE MANURE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
John C. Ward, and E. M. Jex.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 310-326. 5 fig, 4 tab, 25 ref.

Descriptors: *Farm wastes, *Cattle, *Aqueous solutions, Biochemical oxygen demand, Dissolved solids, Hydrogen ion concentration, Foaming, Oxidation-reduction potential, Coagulation, Waste water treatment.
Identifiers: *Volatile solids, *Colloidal properties, Activation energy.

The primary objective was to investigate the aqueous characteristics (biochemical oxygen demand, conductivity, pH, oxidation-reduction potential, coagulation and colloidal properties, dissolved solids, volatile solids, and foaming) of solutions of cattle manure containing the combined urine and feces present in samples from cattle feedlots. This information could then be used in the design of facilities for treating runoff from cattle feedlots. It was assumed that treatment of this runoff would probably be by means of lagoons used to capture the runoff, and that these lagoons would be artificially aerated. In this type of aerobic treatment, the biochemical oxygen demand is satisfied in much the same way as in a stream. Formulas were developed and explained and 25 references were utilized. (White-Iowa State)
W71-02737

TYPICAL VARIATIONS ENCOUNTERED IN THE MEASUREMENT OF OXYGEN DEMAND OF ANIMAL WASTES,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W71-02738

THE INFLUENCE OF VARIOUS FACTORS ON POULTRY LITTER COMPOSITION,
Pennsylvania State Univ., University Park. Dept. of Animal Science.
F. F. El-Sabban, T. A. Long, R. F. Gentry, and D. E. H. Frear.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 340-346. 4 tab, 18 ref.

Descriptors: *Farm wastes, *Poultry, Nitrogen, Carbohydrates, Insulation, Ventilation, Mineralogy, Moisture, Correlation analysis, Nutrients, Waste water treatment.
Identifiers: *Litter composition, *Nutritive value, Dry matter, Crude protein, True protein, Ether extract, Crude fiber.

A study was conducted to determine the chemical composition of poultry waste (litter and manure), relevant to its possible utilization as a source of nutrients. Litter samples were obtained from 33 broiler houses and 22 laying houses. Fresh manure was secured from 5 houses having layers in cages. The dry matter content was determined and samples were analyzed for crude protein, true protein, crude fiber, ether extract, and total ash. In addition, twelve mineral elements were determined. Poultry litter was found to contain considerable amounts of nutrients, particularly nitrogen and carbohydrates. Various factors such as bird type, bird density, kind of litter base material, litter depth, and poultry house conditions (ventilation, insulation, and house temperature) were all found to affect the proximate components of poultry litter. If poultry waste is to be utilized for its nutritive value for plants or animals, it is recommended that each batch be chemically analyzed before use. Although a limited number of samples was available, variation in composition was sufficient to warrant their individual analysis. (White-Iowa State)
W71-02740

REMOVAL OF WATER FROM ANIMAL MANURES,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 347-362, 1969. 8 fig, 2 tab, 12 ref.

Descriptors: *Farm wastes, *Poultry, *Moisture content, Odor, Weight, Volume, Humidity, Waste water treatment.
Identifiers: *Equilibrium moisture content, *Relative humidity, Handling characteristics, Volatile solids, Drying times, Thermal removal.

The removal of water from animal manures changes the handling characteristics of the manure, reduces the weight and volume to be handled, and reduces the offensive odor of the manure. Water can be removed from manure by mechanical, thermal, and absorptive means. Mechanical methods such as direct pressing present the difficulty of the removed water containing considerable volatile solids. Thermal removal was investigated from the standpoint of utilizing a thin layer, unheated air, and very low or 'static' air velocity. The equilibrium moisture content of chicken manure is comparable with other agricultural hygroscopic materials. Equilibrium moisture content values are presented for temperatures 70, 90, 110F. Drying times for chicken manure under these conditions is in terms of days. Drying times are greatly influenced by sample variation. Effects of humidity on drying time are significant but sample variation has an effect similar to a plus or minus 15% relative humidity change. Moisture loss from a 'deep' layer of manure is less than that from a free water surface. (White-Iowa State)
W71-02741

RELATIVE ECONOMICS OF ANIMAL WASTE DISPOSAL BY SELECTED WET AND DRY TECHNIQUES,
Resource Engineering Associates, Inc., Stamford, Conn.
Robert W. Okey, Robert N. Rickles, and Robert B. Taylor.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 369-387, 1969. 5 fig, 17 tab, 11 ref.

Descriptors: *Farm wastes, *Cattle, *Cost analysis, Effluent, Biochemical oxygen demand, Chemical oxygen demand, Odor, Aeration, Nitrogen, Denitrification, Ultimate disposal, Incineration, Waste water treatment.
Identifiers: Wet systems, Dry systems, Effluent standards, Clarifier systems, Biological conversion, Solids conditioning system, Scrubbing system, Ancillary system.

The report presents the basic elements required for the design of two waste treatment facilities to handle the wastes from feedlots carrying 500, 1000, 5,000, 10,000, and 25,000 animals. The plants were designed to meet specified liquid and gaseous effluent standards. The standards selected are believed to be consistent with present and projected effluent requirements. It should be noted that some water courses may not be able to assimilate effluents of the quality discussed here. The two systems designed and costed in this work employed on one hand more or less conventional liquid waste treatment procedures; the other employed incineration and treated the undiluted animal waste as delivered as a solid waste, i.e., sludge. The capital and operational cost of these systems were computed and related to the number of animals and the gain anticipated in the feedlot. A waste treatment cost in terms of animal-years and per pound was then obtained. Five conclusions were reached as a result of the study, among them, that wet systems are more expensive to own and operate than systems designed to handle solids. (White-Iowa State)
W71-02743

THE ECONOMICS OF POULTRY MANURE DISPOSAL,
New York State Coll. of Agriculture, Ithaca.
R. E. Linton.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 388-392, 1969.

Descriptors: *Farm wastes, *Poultry, *Economics, *Land use, Fertilizers, Nitrogen, Phosphorus, Potash, New York, Disposal, Waste water treatment.
Identifiers: *Land disposal, *Cost calculations, *Waste management, Transportation costs, Catskill resort industry.

This study was initiated in response to the general problem of conflicts over rural land use, particularly those involving farm operations. More specifically and as a notable example, the study dealt with the problems of conflict between poultry and other land uses. The problem of land use conflict related to waste management was approached through the aspect of recognizing the internal costs to farmers of some of the alternatives in waste management. As a result of the study one particular pattern of manure disposal seemed to justify serious consideration and was singled out for discussion and cost calculations. This pattern included some means of land spreading as a practical and acceptable disposal method. Comments were made about the value of poultry manure in replacing commercial fertilizer, and this value is discussed as a means of at least partial disposal cost recovery. (White-Iowa State)
W71-02744

ECONOMIC RETURN FROM VARIOUS LAND DISPOSAL SYSTEMS FOR DAIRY CATTLE MANURE,
Cornell Univ., Ithaca, N.Y.
L. W. McEachron, P. J. Zwerman, C. D. Kearl, and R. B. Musgrave.
Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 393-400, 1969. 11 tab, 13 ref.

Descriptors: *Farm wastes, *Fertilizers, *Rotations, Cattle, Economics, Soil types, Disposal, Waste water treatment.
Identifiers: *Dairy cattle, Land disposal, Continuous corn, Lima silt loam, Manure hauling and spreading, Total digestible nutrients.

Census of Agriculture data are presented to indicate that dairy cattle manure could well be disposed of on the land. Farm cost accounting data are presented to indicate that cost per ton of hauling and spreading averaged $1.92 for farms with free stalls and about 140 cows to $3.18 for those with stanchions and 65 cows. Percent yield increase on crops grown per ton of manure applied range from .4% for oats to 6.6% for alfalfa. These

percent yield increases were generalized without regard to mineral fertilization and applied to Warren's (1968) yield data for the state of New York at various farming levels. Without a charge for hauling and spreading dairy cattle manure crop yield returns ranged from $1.42 per tone to a deficit of $0.26. (White-Iowa State)
W71-02745

ECONOMIC EVALUATION OF LIQUID MANURE SYSTEMS FOR FREE STALL DAIRY BARNS,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
George L. Casler.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 401-406, 1969. 3 tab.

Descriptors: *Farm wastes, *Economics, *Value, Cattle, Costs, Odor, Fertilizer, New York, Waste water treatment.
Identifiers: *Liquid manure system, *Labor distribution, *Labor requirements, Dairy cattle, Free stall barns.

The purpose was to evaluate liquid manure systems in free-stall dairy barns primarily from an economic viewpoint. If a liquid manure system is to be justified, such justification will have to be based on other advantages in addition to increased manure value and reduced labor requirement. The primary other advantage is the possibility of not hauling manure at periods of peak labor demand for planting and harvesting crops. However, to actually reap the benefits of improved labor distribution, a dairyman needs a reasonably long storage period and must very carefully plan his cleaning schedule. In addition, the very unpleasant odor created at the time the storage tank is emptied precludes the use of a liquid manure system in areas where neighbors would object to this odor. It appears to the author that the air pollution or odor problem is much more serious with a liquid manure system than with daily apreading. (White-Iowa State)
W71-02746

WHO SHOULD REGULATE POULTRY CONFLICT PROBLEMS,
Cornell University, Ithaca, N.Y. Coll. of Agriculture.
David J. Allee, and Pierre Clavel.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 407-414, 1969. 5 ref.

Descriptors: *Farm wastes, *Poultry, *Technology, Local governments, State government, Odor, Communication, Waste water treatment.
Identifiers: *Regulatory mechanisms, Industry committee, Political resources, Waste management technology, Conflict, Resolution of problems.

Economic and social theory applicable to conflict situations, such as those that arise downstream or downwind from poultry houses, has some ability to indicate directions for administered solutions to these problems. Based upon such theory, related research and a case study of a number of ways in which rural communities have dealt with situations of stress between components of the community, the outlook for regulatory devices is appraised. An informal voluntary industry committee approach is found to be as effective in bringing together necessary technical expertise and social regulatory mechanisms as any other approach which the limited resources of many rural communities can support. It is suggested that because of a shortage of administrative and political resources many rural areas will resist effective resolution of conflict problems due to agricultural wastes until finally controls will be imposed by essentially urban oriented units of government. (White-Iowa State)
W71-02747

BEEF CONFINEMENT SYSTEMS - OXIDATION DITCH,
Minnesota Univ., Minneapolis. Dept. of Agricultural Engineering.
J. A. Moore, R. E. Larson, R. O. Hegg, and E. A. Allred.
Paper No 7331 in the Scientific Journal Series, Minnesota Agricultural Experiment Station; and Paper No 70-418, American Society of Agricultural Engineers, July 1970.

Descriptors: *Farm wastes, *Cattle, Chemical oxygen demand, Biochemical oxygen demand, Ventilation, Rotors, Foaming, Temperature, Hydrogen-ion concentration, Dissolved oxygen, Nitrogen, Ammonia, Waste water treatment.
Identifiers: *Oxidation ditch, Beef cattle, Loading rates, Solids.

The oxidation ditch has been used in Minnesota for two years for treatment of beef cattle wastes. It has been operated as a batch system with various loading rates and environmental conditions. Results are evaluated on the basis of BOD, COS, TS, TVS, pH, nitrogen, temperature of the waste, and odor and foam control. Waste management systems are employed by beef operators to meet certain objectives. These objectives may vary widely depending on such factors as management, labor requirements, climate, size and nature of operation, land availability, soil type and geologic formation and population density. No one waste system is best for all operations. Each system has advantages and disadvantages to offer for any given operation. The oxidation ditch offers the following characteristics: very low odor level, waste storage eliminates runoff, volume reduction of solids, reduction of pollution strength, concentration of some elements, necessity of continuous operation, one of more expensive treatment systems, and a buildup of solids on the bottom. Based on the results obtained from 2 1/2 years of research the authors feel that the oxidation ditch does have a place in treating beef cattle waste from confinement operations. (White-Iowa State)
W71-02748

FARMYARD MANURE HANDLING.
Ministry of Agriculutre, Fisheries and Food, London (England).

Mechanization Leaflet For Farmers and Growers, No 8, December 1965. 6 p.

Descriptors: *Farm waste, *Disposal, *Equipment, Operations, Waste water treatment.
Identifiers: *Machinery, *System, Loaders, Spreaders, Scrapers, United Kingdom.

This leaflet describes the more important types of equipment and working methods used at present in the United Kingdom for farmyard manure handling. Loading and spreading equipment are discussed. Recommendations are made as to the most efficient methods of combining the available men and equipment into an operating system for manure disposal. (Christenbury-Iowa State)
W71-02749

5E. Ultimate Disposal of Wastes

A DESIGN STUDY ON THE ECONOMIC USE OF AGRICULTURAL WASTES IN KANSAS.
Kansas Dept. of Economic Development.

Available from NTIS as PB-194 368, $3.00 in paper copy, $0.95 in microfiche. Kansas Planning for Development Report No 25, Jan 1969. 183 p, 32 tab, 11 fig, 625 ref. HUD Grant to Kansas Department of Economic Development.

Descriptors:
Identifiers: *Agricultural wastes, Utilization, *Waste disposal, Effectiveness, *Economic development, *Kansas, Management planning, Benefit cost analysis, Research projects, Environmental engineering, Water pollution, Control.

The report represents a study of agricultural wast in Kansas and the technology available f economic utilization. The principal wastes that m provide raw materials for profitable utilization a identified and data on location and quantity of ea waste are presented. The most important agricu tural waste in Kansas comes from large catt feedlots. Since disposal is costly to the cattle fee ing industry utilization technology is sought to pr vide raw material for economic development.
W71-02302

DEEP WELL DISPOSAL STUDY FOR BAL WIN, ESCAMBIA AND MOBILE COUNTIE ALABAMA,
Alabama Geological Survey, University.
Roy M. Alverson.
Alabama Geological Survey Circular 58, 1970. 4 p, 8 fig, 10 plate, 1 tab, 15 ref, append.

Descriptors: *Injection wells, *Waste wat disposal, *Industrial wastes, *Alabama, Aquife Water pollution control, Permeability, Porosit Water quality, Hydrologic data, Hydrogeolog Groundwater movement, Stratigraphy.
Identifiers: *Mobile (Ala), *Waste disposal wells.

Baldwin, Escambia, and Mobile Countie Alabama, have a combined area of 3,817 squa miles and a population of 396,900 in the highly i dustrialized Mobile metropolitan area. The area underlain by sedimentary rocks of the type used reservoirs for waste disposal in other parts of t United States. Under certain geologic, hydrolog and geochemical conditions deep-well injection liquid industrial waste can be carried out effectiv ly in southwest Alabama. Each proposal, howeve must be carefully evaluated, using the criteria ou lined in this report to insure against pollution fresh-water supplies, surface and ground, and pr tect atainst damage to the environment in the su surface or at the surface. (Knapp-USGS)
W71-02428

THE VALUE OF HYDROLYZED AND DRIE POULTRY WASTE AS A FEED FOR RUM NANT ANIMALS,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 05D.
W71-02714

CATTLE MANURE: RE-USE THROUG WASTELAGE FEEDING,
Alabama Agricultural Experiment Station, A burn.
For primary bibliographic entry see Field 05D.
W71-02715

SPECIFICATIONS FOR EQUIPMENT FO LIQUID MANURE DISPOSAL BY THE PLOW FURROW-COVER METHOD,
Rutgers - The State Univ., New Brnuswick, N Dept. of Agricultural Engineering.
Charles H. Reed.
In: Animal Waste Management, Proceedings Co nell University Conference on Agricultural Was Management, 1969, p 114-119. 8 fig.

Descriptors: *Slurries, *Disposal, Farm wast Poultry, Waste water disposal.
Identifiers: *Plow-furrow-cover, Utilization.

A condensation is presented of experimental wo that was done on land application of poul manure slurries. Several pieces of equipment a different operations were looked at. Most inco porated a single bottom 16 in. plow operating 7 to 8 in. deep. Manure was deposited in the furr and then covered. Tank trailers and commerc liquid manure tanks were used to transport a funnel the slurry into the furrow. General pe formance specifications for plow-furrow-cov equipment is included. (White-Iowa State)
W71-02716

STATUS REPORT ON WATER POLLUTION CONTROL FACILITIES FOR FARM ANIMAL WASTES IN THE PROVINCE OF ONTARIO,
For primary bibliographic entry see Field 05D.
W71-02719

MANURE CONSERVATION,
HUPSI Corp., Wabash, Ind.
For primary bibliographic entry see Field 05D.
W71-02730

PROBLEMS AND PRACTICES IN SOME SYSTEMS OF MANURE HANDLING IN NORTHERN EUROPE,
Cornell Univ., Ithaca, N.Y. Dept. of Animal Science.
For primary bibliographic entry see Field 05D.
W71-02732

THE INFLUENCE OF VARIOUS FACTORS ON POULTRY LITTER COMPOSITION,
Pennsylvania State Univ., University Park. Dept. of Animal Science.
For primary bibliographic entry see Field 05D.
W71-02740

THE ECONOMICS OF POULTRY MANURE DISPOSAL,
New York State Coll. of Agriculture, Ithaca.
For primary bibliographic entry see Field 05D.
W71-02744

ECONOMIC RETURN FROM VARIOUS LAND DISPOSAL SYSTEMS FOR DAIRY CATTLE MANURE,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05D.
W71-02745

5F. Water Treatment and Quality Alteration

METROPOLITAN WATER SYSTEM OPERATION SUBSEQUENT TO NUCLEAR ATTACK OR NATURAL DISASTER,
Dallas Water Utilities Dept. Tex.
Dan A. Brock.
Available from NTIS as AD-711 956, $3.00 in paper copy, $0.95 in microfiche. Final Report, May 1970. 364 p, 29 tab, 6 fig, 6 ref.

Descriptors:
Identifiers: *Water supplies, Management planning, *Nuclear warfare, Water supplies, Disasters, Mathematical models, Nuclear explosion damage, Vulnerability, Civil defense systems, Power supplies, Post attack operations, *Post attack planning, Computerized simulation, Post attack recovery.

The study develops methodology for creation of a plan for operation of a metropolitan water system subsequent to nuclear attack or natural disaster. Automatic digital computer water system simulation is used to determine the ultimate overall effect of damage to specific components. Vulnerability analyses are made as a mathematical model of the water system reacts automatically to hypothetical attack data supplied by the National Civil Defense Computer Center. Problems of unmanned water purification plant operation are noted. The need for and availability of electric power is considered.
W71-02299

REGIONAL WATER AND SEWERAGE FACILITIES PLAN 1990.
Indian Nations Council of Governments, Tulsa, Okla.
For primary bibliographic entry see Field 05D.
W71-02611

5G. Water Quality Control

POTOMAC-SHENANDOAH RIVER BASIN COMPREHENSIVE WATER RESOURCES PLAN: VOLUME 5-ENGINEERING DEVELOPMENT ALTERNATIVES.
Virginia Dept. of Conservation and Economic Development, Richmond. Div. of Water Resources.
For primary bibliographic entry see Field 06B.
W71-02216

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02217

A MODEL RELATING WATER QUALITY, VEGETATIONAL STRUCTURE AND URBANIZATION IN THE SAN JACINTO RIVER BASIN,
Houston Univ., Tex. Dept. of Biology.
David L. Jameson.
Available from NTIS as PB-196 094, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, December, 1970. 49 p, 11 tab, 2 fig, 8 ref. OWRR Project B-045-TEX (1).

Descriptors: Ecology, *Water quality, *Model studies, *Vegetation, *Urbanization, Texas, Biomass, Statistical models, Probability, Soil analysis, Data processing.
Identifiers: San Jacinto River Basin (Texas), Water quality models, River basin models.

This study was initiated to test the hypothesis that available information was sufficient to predict the relation between amount of urbanization and the quality of the water in the watershed of the San Jacinto River Basin. Chemical water quality measures are the published and unpublished records of the U.S. Geological Survey. Unpublished records of the Houston Water Department provided portions of the Biological Water Quality measures. Predictor variables included soil, weather, population characteristics, and estimates of vegetation type and urbanization obtained from aerial photographs. Factor, discriminant and canonical correlation analyses were used for data reduction. Two models were attempted. The first used the data to construct a matrix model of the relation between predictors and water quality. The second model used a probability distribution of biomasses in the vegetational community to examine the reduction in the community possible without destroying the community and thus destroying the contribution of community to water quality. The results from both models were rejected because of the general incompleteness of the predictor data and because the available predictor data were not directly related to water quality in the areas where data were available. (Jameson-Houston)
W71-02271

INVESTIGATIVE MINE SURVEY OF A SMALL WATERSHED, A FIELD INVESTIGATION TO LOCATE AND DEFINE UNKNOWN OR HIDDEN DRIFT MINE OPENINGS IN THE BROWNS CREEK WATERSHED OF THE WEST FORK RIVER IN WEST VIRGINIA.
Halliburton Co., Duncan, Okla.

Available from NTIS as PB-196 110, $0,95 in microfiche. Available from SOD as: SOD No 167.13/4:14010 DMO 03/70 PC$2.00. Water Pollution Control Research Series 14010 DMO-A, March, 1970. 89 p, 16 tab, 32 fig, 4 ref, append. FWQA Program 14010 DMO, Contract NO 14-12-453.

Descriptors: Drift mining, Mining, Mining engineering, West Virginia, *Strip mines, Mine drainage, Water pollution control, Mine water, Exploration.
Identifiers: Mine surveys, Browns Creek watershed (West Virginia), *Mine openings (Hidden), Auger Probes, Mines drifts, Highwall location (Mines).

The primary purpose of this project was to conduct an investigation to locate hidden or unknown drift mine openings in the Browns Creek Watershed in Harrison County, West Virginia. Thirty unknown openings were discovered in an initial reconnaissance. Additional probing using power driven augers was not successful and was deemed impractical. Three specific areas within the watershed were selected for further scrutiny. The bottom of the highwall line in the strip mined area was determined by land surveyors and this information was plotted on old mine maps to indicate the intersection of the stripping with underground mining. A minimum of 107 mine drifts were shown to be exposed by the 14,500 feet of highwall surveyed in the three areas.
W71-02275

URBAN SOIL EROSION AND SEDIMENT CONTROL,
National Association of Counties Research Foundation, Washington, D.C.
For primary bibliographic entry see Field 04D.
W71-02276

MICROBIAL FACTOR IN MINE DRAINAGE FORMATION,
Mellon Inst., Pittsburgh, Pa.
Robert A. Baker, and Albert G. Wilshire.
Available from NTIS as PB-196 113, $0.95 in microfiche. For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.70 PC Order no 13/4:14010 DKN 11/70. Water Pollution Control Research Series 1410 DKN 11/70, July 1970. 68 p, 12 tab, 22 fig, 36 ref, append. FWQA Program Grant No 14010DKN.

Descriptors: *Mine drainage, Mine acid, Mine wastes, *Mine water, *Acid mine water, Bacteria, *Ferrobacillus, *Thiobacillus, Effluents, Aeration, *Pyrite, Acidic water, *Coal mine wastes, Iron, Sulfate.
Identifiers: *Chemoautrophic microorganisms, Mine models, Algal growth, Ferrobacillus ferrooxidans, Ferrobacillus sulfooxidans, Thiobacillus thiooxidans.

The role of chemoautrophic organisms in the formation of acid mine drainage from pyritic materials associated with coal mining has been investigated by pilot plant techniques. Dynamic flow, controlled environment units which served as models of mines were used. It was demonstrated that the concentration of acidity, ferrous and total iron and sulfate in the effluent from aerobic, biologically-seeded or unseeded pyritic beds is zero order with respect to flow, except at low flow rates where mass transport is diffusion limited. Algal growth occurred in the acidic, aerobic environment but did not affect acid production. Nonaerobic systems produce acidity consisting only of ferrous iron. Total acidity is lower from biologically-seeded than -nonseeded aerobic systems. Acid mine drainage was not significantly affected by seeding with the individual or a mixture of three different organisms but was increased by recycle of the flow and increased appreciably under forced aeration. The rate is directly related to the available pyrite surface area. (Shackelford-FWQA)
W71-02278

COMBATTING SALT-WATER ENCROACHMENT INTO THE BISCAYE AQUIFER--MIAMI, FLORIDA AREA,
Dade County Public Works Department, Miami, Florida.
For primary bibliographic entry see Field 04B.
W71-02283

A DESIGN STUDY ON THE ECONOMIC USE OF AGRICULTURAL WASTES IN KANSAS.
Kansas Dept. of Economic Development.
For primary bibliographic entry see Field 05E.
W71-02302

PROCEEDINGS OF THE NATIONAL CONFERENCE ON SEDIMENT CONTROL.
Dept. of Housing and Urban Development, Washington, D.C. Office of Metropolitan Planning and Development.
For primary bibliographic entry see Field 04D.
W71-02425

A HYDROLOGICAL APPROACH TO CONTROL ACID MINE POLLUTION FOR LAKE HOPE,
Ohio Univ., Athens. Dept. of Geology.
Moid Uddin Ahmad.
Goundwater, Vol 8, No 6, p 19-24, November-December 1970. 6 p, 14 fig, 4 ref.

Descriptors: *Acid mine water, *Water pollution control, *Ohio, *Water pollution sources, *Groundwater movement, Acid streams, Mine acids, Mine drainage, Injection wells, Drainage systems, Subsurface drains, Appalachian Mountain region.
Identifiers: Acid mine drainage, Mine acid control, Vinton County (Ohio).

In the Appalachian region, coal mining has disturbed the natural ground flow system. The mines are continuously being flushed by this disturbed flow system and are producing sulphuric acid. In the McDaniel Mine, Ohio, the flow is lateral and clay layers under the coal do not allow water to leak into the underlying aquifer. Water well logs collected within 10 moles of the Todd Mine show the existence of three separate aquifers. A pilot plan for Todd Mine proposes to discharge the uncontaminated water from the upper aquifer to the lower aquifer, and should stop the flow of water through the mine. This scheme is intended to solve the serious problem of pollution of Lake Hope, Ohio. (Knapp-USGS)
W71-02427

EFFECTS OF LAND MANAGEMENT ON QUANTITY AND QUALITY OF AVAILABLE WATER,
New South Wales Univ., Kensington (Australia). Water Research Lab.
For primary bibliographic entry see Field 04C.
W71-02452

ECONOMIC CONSIDERATIONS IN THERMAL DISCHARGE TO STREAMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
George O. G. Lof, and John C. Ward.
In: Engineering Aspects of Thermal Pollution, Chapter 10, p 282-301, 1969.

Descriptors: *Thermal pollution, *Cooling water, *Economics, Temperature, Thermal power plants.
Identifiers: *Thermal discharge, Evaporation losses.

The economic consequences of thermal discharge from steam-electric power plants, the largest users of cooling water, are modest increases in operating costs by the downstream users. It is observed that the operating cost of recirculation cooling merely to reduce the temperature of an inlet cooling water supply is greater than the benefit. The annual expense C sub I in cents per thousand gallons of water circulated is given in terms of the cooling tower investment per unit capacity (dollar/gpm); r, the interest rate; t, cooling tower service life (years); P, annual property-taxation rate; and N, the load factor. Costs of operation are functions of R, the cooling range in F; C, the cycles of concentration; Y, alkalinity of make up water; W sub a, cost of make up water; K, the relative rating factor of cooling tower, p, the height to which water must be pumped for flow through the cooling tower (feet); and A, cost of electric power (cents/kwhr). Results of a downstream power plant using warmer condenser water than would naturally have been available are a decrease in total electrical generation and a decrease in thermal efficiency, hence, an increase in costs per kilowatt-hr generated. The net additional cost of powerplant due to such temperature increase, can be expressed in terms of theoretical steam cycle efficiency, turbine generator efficiency, fractional decrease in plant load factor per year, the temperature change in the water steam, present load factor of the plant, the powerplant life, and the natural temperature of cooling water unaffected by thermal discharge upstream. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02488

RESEARCH NEEDS FOR THERMAL POLLUTION CONTROL,
Federal Water Pollution Control Administration, Corvallis, Oregon. Pacific Northwest Water Lab.
Bruce A. Tichenor, and William A. Cawley.
In: Engineering Aspects of Thermal Pollution, Chapter 12, p 329-338, 1969.

Descriptors: *Thermal pollution, *Temperature, Ecology, Thermocline, Hypolimnion.
Identifiers: *Research needs, Treatment processes, Non-treatment control technology transfer.

The research needs for thermal pollution control are segmented into transport and behavior of heat in water, and treatment processes and non-treatment controls. More information is needed on what happens when a heated discharge is inserted in either the thermocline or hypolimnion of a stratified reservoir. Other important items are, development of non-empirical, stochastic temperature-prediction models, improvement of the effectiveness of cooling devices for handling large thermal loads and development of methods for effectively utilizing waste heat including industrial and agricultural use. In considering research needs, it is important to recognize that research involves several levels of activities which include, scientific advancement, fundamental development, design and application and technology transfer. Each of three segments of our society, the regulatory agencies, the pollution and the water user should carry a fair share of responsibility. An interdisciplinary research effort to control thermal pollution, calling for the participation of all relevant segments of technical community is needed. (See also W71-02478) (Upadhyaya-Vanderbilt)
W71-02489

YOUNG V INTERNATIONAL PAPER CO (LIABILITY FOR DESTRUCTION OF GROWING TIMBER BY FLOODING).
For primary bibliographic entry see Field 06E.
W71-02567

CONTROL OF ODORS FROM ANIMAL WASTES,
W. E. Burnett, and N. C. Dondero.
Transaction of the ASAE, Vol 13, No 2, p 221-224, 231, March 1970. 3 fig, 5 tab, 15 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, *Chemicals, Costs.
Identifiers: *Odor panel, *Masking agents, *Counteractants, Deodorants, Digestive deodorants, D-indices.

A matching-standard method was successfully used for the evaluation of the ability of commercial odor-control chemicals to mask or eliminate the offensive odor of poultry manure when added directly to the waste in both loboratory and field tests. The method enables one to find the most effective chemicals in a systematic and relatively time-saving manner. The method provides information on the lowest concentration of chemical necessary to obtain a desired effect. Masking agents and counteractants were found to be the most effecti odor-control products, deodorants were moderat ly effective, and digestive deodorants were least e fective. The cost in some field trials was estimate to be 63 cents per 450 gal. of liquid manur Further research is needed on the effect of r peated applications of odor-control products c soil, so as not to harm the soil for other purpose (White-Iowa State)
W71-02624

SOME ECONOMIC PLANNING CONSIDERA TIONS OF GROUNDWATER POLLUTION FO THE UPPER PAWCATUCK RIVER BASIN I RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Econom Planning and Regional Development.
Arnold Joseph Antak.
Masters Thesis, 1970. 119 p, 8 fig, 23 tab. OWR Project A-032-RI (1).

Descriptors: *Water supply, *Groundwate *Economics, *River basin development, Optimu development plans, Project planning, Long ter planning, Water pollution control, Water manag ment (Applied), Water resources developmer Water sources, Planning, Rhode Island.
Identifiers: *Pawcatuck River Basin, R. *Groundwater pollution.

This thesis is concerned with the economics of su plying potable water to the Upper Pawcatuck Riv Basin in Rhode Island. The basic question co sidered was whether or not it is more economical develop and maintain pollution - free the lar groundwater reserves in existence there, or to n protect these groundwaters, and instead, develop surface water supply. Groundwater developme and protection would consist of a large municip well development and regional sewerage faciliti to prevent the private disposal of sewage. Altern tive development of a surface water supply wou require an impounding reservoir. It was found th no serious groundwater pollution proble presently exists, but that the potential for futu problems does exist. Cost data were obtained fro various sources and estimates of the development costs of regional sewerage facilities, municip groundwater development, and a surface impoun ing reservoir were made. It was found that the cor bination of groundwater development, and region sewerage was less expensive than the developme of a surface water supply for systems of simil capacity. It is recommended that the planning water supplies and sewerage be done on a cor prehensive basis by considering them as a sing function. (Hewett-Rutgers)
W71-02628

FACILITY PLANNING FOR A PUBLIC SE VICE SYSTEM: DOMESTIC SOLID WAST COLLECTION,
University of Southern California, Los Angele Dept. of Urban and Regional Planning.
For primary bibliographic entry see Field 06A.
W71-02632

PHOSPHORUS, NITROGEN, AND ALGAE I LAKE WASHINGTON AFTER DIVERSION O SEWAGE,
Washington Univ., Seattle. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W71-02681

PRINCIPLES AND PRACTICES OF BEEF CA TLE FEEDLOTS,
Queensland Univ., Brisbane (Australia). Dept. Animal Husbandry.
W. J. Pryor.
Australian Veterinary Journal, Vol 46, No 4, Ap 1970, p 173-177. 2 tab, 1 fig, 17 ref.

Descriptors: *Cattle, *Animal diseases, *Cost Profit, Nutrient requirements, Silage, Sorghu Wheat, Performance, Water pollution control.

Identifiers: *Feedlots, Feelot management, Feeding systems, Green chop.

It is believed the emergence of a large feedlot industry will be dependent primarily on two factors, the first being the availability of cheap feed and the availability of store cattle at a price which will permit a margin after they have been lot fattened, and the other, the introduction of a satisfactory national system of carcass grading and identification. A description is given of the principles involved in the management of feedlots with special reference to conditions operating in northern Australia. The importance of concentrate to roughage ratios and protein and mineral requirements are stressed. Diseases have played only a minor part in feedlot management in Australia thus far, and it is suggested that the veterinarian can play a more useful role in supplying sound advice on economic feeding and management. (White-Iowa State)
W71-02691

LOCATING A POULTRY ENTERPRISE,
Illinois Univ., Urbana.
S. F. Ridlen, and Hugh S. Johnson.
Illinois Monthly Poultry Suggestions, July 1970. Poultry Digest, Vol 29, No 344, p 495-496, October 1970.

Descriptors: *Locating, Farm wastes, *Poultry, Eggs, Water pollution control.
Identifiers: *Enterprise, Neighbor problems.

The chief characteristics that should be evaluated in selecting the location of a poultry enterprise are discussed. These include land cost, tax rate, water supply and topography; electricity, labor, feed supply and transportation should be considered; human population, zoning, acceptance of poultry by local people and relationship to market are important. (Christenbury-Iowa State)
W71-02698

ANIMAL WASTE MANAGEMENT.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05D.
W71-02701

REFLECTIONS ON POLLUTION CONTROL,
Zurn Industries, Inc., Washington, D.C.
Leon W. Weinberger.
In: Animal Waste Management, Proceedings, Cornell University, Conference on Agricultural Waste Management, p 1-3, 1969.

Descriptors: *Farm wastes, *Water pollution, *Water quality, *Cost-benefit ratio, Water pollution control, Environment, Waste water treatment.
Identifiers: *National policy, National misconception.

Dr. Weinberger expresses three personal viewpoints dealing with national policy on water pollution control, cost benefit analysis in water pollution control, and finally comments on the greatest myth or misconception in water pollution control. This national misconception being that we do not know how to solve the problems of water pollution control. Dr. Weinberger asks everyone to speak out and be heard on the way that you want to have our environment. (White-Iowa State)
W71-02702

EFFECTS OF WATER QUALITY STANDARDS ON THE REQUIREMENTS FOR TREATMENT OF ANIMAL WASTES,
Federal Water Pollution Control Administration, Washington, D.C.
Harold Bernard.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 9-16. 1 tab, 2 fig, 5 ref.

Descriptors: *Farm wastes, *Legal aspects, *Water quality act, Biochemical oxygen demand, Chemical oxygen demand, *Water quality standards, Municipal wastes, Industrial wastes, Waste water treatment.
Identifiers: FWPCA, Animal feedlot, *Disposal requirements, *Waste treatment standards, Environmental backlash, Interstate waters.

Changes that have taken place in water quality standards are discussed. The purpose of the standards is to: (a) provide an engineering base for the design of waste treatment works by municipalities and industries without uncertainties in waste disposal requirements in interstate waters. (b) Serve as a clear public (local) policy statement on the use or uses to which specific segments of interstate waters may be put after due consideration of all the factors delineated above. The effect of these changes in standards is discussed with relation to the treatment of animal wastes. Future municipal B.O.D. loads and their subsequent treatment costs are brought out. It is mentioned that the FWPCA is interested in receiving proposals to demonstrate new or unique treatment and control techniques for animal wastes, especially in conjunction with an on-going operation. Only with the cooperation and leadership of the industry itself can techniques be developed to meet the various water quality standards and enable the industry a growth unimpeded by any environmental backlash. (White-Iowa State)
W71-02704

THE CHALLENGE OF ANIMAL WASTE MANAGEMENT,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 17-22. 5 ref.

Descriptors: *Farm wastes, Odors, Waste water treatment.
Identifiers: *Animal production, *Waste management, Environmental quality, Interrelationships of animal production, Study and research.

There is a woeful lack of understanding of the interrelationships between various aspects of animal production and waste management. It is to this point and to these relationships that this paper is addressed. The long term approach for animal production must be based upon not only optimal production of the product, but also on management of the entire production scheme such that it is consistent with the maintenance of acceptable environmental quality not only to the animals, and to the producers, but to society as a whole. The problem of animal waste management is actually many problems. It consists of technical, economic, social, educational, and perhaps above all, a communications problem. The talents of individuals from many disciplines are needed to produce better solutions to the problem. We need to initiate more studies that will take an overview of the animal production operation, feasible waste management systems, and their interrelationships. These studies should develop information that can be used as predictive and/or decision making tools to anticipate and minimize problems that may result. Herein lies the greatest challenge of animal waste management. (White-Iowa State)
W71-02705

DESIGN PARAMETERS FOR THE STABILIZATION OF HIGHLY ORGANIC MANURE SLURRIES BY AERATION,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 05D.
W71-02707

FEEDLOT POLLUTION CONTROL - A PROFILE FOR ACTION,
Federal Water Pollution Control Federation, Kansas City, Mo. Missouri Basin Region.
John M. Rademacher, and Anthony V. Resnik.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 193-202. 17 ref.

Descriptors: *Farm wastes, *Water pollution control, *Legislation, Groundwater, Water Quality Act.
Identifiers: *Feedlots, *Animal production, Research, Regulation.

This paper set the stage for the presentation of technical papers which followed at the Cornell University Animal Waste Management Conference. The background of animal production and examples of the pollution problem were given. Factors causing the problem of animal waste disposal were discussed as well as accomplishments to date. These accomplishments included Federal laws to control pollution. A profile for action was presented as a model for action. The essential elements were Re-education, Research and Regulation. He states that we have neither adequate knowledge for control nor full cooperation and involvement of all levels of Government and the private sector to solve the problems resulting from feedlot operations. More attention must be given to feedlot location and research devoted to the institutional problems of animal waste management. There must be an organized and coordinated, interdisciplinary approach to animal waste disposal. (White-Iowa State)
W71-02725

CATTLE FEEDLOT WATER QUALITY HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
T. E. Norton, and R. W. Hansen.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 203-216. 2 tab, 14 fig, 14 ref.

Descriptors: *Farm wastes, *Cattle, *Hydrographs, *Water quality, Rainfall simulators, Rainfall intensity, Biochemical oxygen demand, Runoff, Alkalinity, Water pollution control, Waste water treatment.
Identifiers: *Feedlot runoff, *Hydrology characteristics, Surface storage, Effective depth, Overland flow.

The hydrologic and quality characteristics of runoff waste water resulting from precipitation on cattle feedlots are presented. The overall objective of the study was to determine if the hydrology characteristics could be correlated with the quality characteristics through a modification of the flat plate model of overland flow. Once this correlation was established, the results were used to predict the quantity and quality of the runoff from existing feedlots. The field equipment consisted of rainfall simulation equipment and a sample collection and control device. Runoff was collected and analyzed from a 28 sq. ft. plot in 18 separate runs on 13 different feedlots. The pollution characteristics of BOD, dissolved solids and alkalinity were correlated with an effective depth of overland flow. The correlation method and equations developed were used in an example of BOD prediction. (White-Iowa State)
W71-02726

THE EFFECT OF FEED, DESIGN AND MANAGEMENT ON THE CONTROL OF POLLUTION FROM BEEF CATTLE FEEDLOTS,
Texas Technological Coll., Lubbock. Dept. of Agricultural Engineering.
W. Grub, R. C. Albin, D. M. Wells, and R. Z. Wheator.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, 1969, p 217-224. 5 fig, 2 tab.

Descriptors: *Farm wastes, *Cattle, *Runoff, Biochemical oxygen demand, Nitrogen, Phosphorus, Water pollution control.

Identifiers: *Feedlots, *Composition of wastes, Rations, Feedlot layout, Waste accumulation.

Incorporating both engineering and biological aspects, this report contains an analysis of data and suggests management and design practices that could materially reduce the pollution contributed from the small but densely populated feedlot area. The composition and quantity of wastes is looked at. The type of ration and changes in accumulated wastes are discussed in relation to the former topics. The effects of precipitation, surfacing material, land slope, depth of waste accumulation, feedlot layout, and ration composition are discussed with respect to composition and quantity of runoff. (White-Iowa State)
W71-02727

LIVESTOCK PRODUCTION VS. ENVIRONMENTAL QUALITY - AN IMPASSE,
Economic Research Service, Washington, D.C. Natural Resource Economics Div.
Joseph P. Biniek.
In: Animal Waste Management, Proceedings Cornell University Conference on Agricultural Waste Management, p 363-368, 1969. 14 ref.

Descriptors: *Farm wastes, *Economic efficiency, Water Quality Act, Air pollution, Odors, Water pollution control.
Identifiers: *Livestock production, *Production efficiency, *Environmental quality, Quality standards, Public conern, Economic development.

The possibilities of merging the two objectives of production efficiency and environmental quality are explored. To establish a basis for merging the two objectives, the author discusses environmental quality, quality standards, and public concern. Secondly he reviews the changing concepts of economic efficiency and illustrates these changes by discussing four stages of economic development. The discussion is concluded with a section devoted to the merging of the two objectives, environmental quality and production efficiency. An impasses can be averted, but it will require new modes of thought, and constructive responses to new situations. (White-Iowa State)
W71-02742

WHO SHOULD REGULATE POULTRY CONFLICT PROBLEMS,
Cornell University, Ithaca, N.Y. Coll. of Agriculture.
For primary bibliographic entry see Field 05D.
W71-02747

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A MODEL RELATING WATER QUALITY, VEGETATIONAL STRUCTURE AND URBANIZATION IN THE SAN JACINTO RIVER BASIN,
Houston Univ., Tex. Dept. of Biology.
For primary bibliographic entry see Field 05G.
W71-02271

APPLICATION OF THE SSARR MODEL TO A BASIN WITHOUT DISCHARGE RECORD,
Weather Bureau, Salt Lake City, Utah. Western Region.
For primary bibliographic entry see Field 02A.
W71-02297

METROPOLITAN WATER SYSTEM OPERATION SUBSEQUENT TO NUCLEAR ATTACK OR NATURAL DISASTER,
Dallas Water Utilities Dept. Tex.
For primary bibliographic entry see Field 05F.
W71-02299

A DISPERSION MODEL FOR HEATED EFFLUENT FROM AN OCEAN OUTFALL,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 05B.
W71-02605

EXTERNALITIES, OPTIMALITY AND INFORMATIONALLY DECENTRALIZED RESOURCE ALLOCATION PROCESSES,
Northwestern Univ., Evanston, Ill.
Antonia Camacho.
International Economic Review, Vol 11, No 2, p 318-327, June 1970.

Descriptors: *Resource allocation, *Economic planning, Input-output analysis, Economic environment optimization.
Identifiers: *Externalities, *Pareto-satisfactory, Adjustment process, N components, Cartesian product, Set theory.

This paper is mainly devoted to presenting an informationally decentralized adjustment process with Pareto-optimal equilibria for economies or environments where externalities exist. The economic environment is defined as the set of economic units or participants of the economy, their initial resource endowments, and their production possibilities and preferences. The n components of the environment uniquely determine the economic environment and its Pareto-optimal set. The adjustment process is defined as a set of rules for exchanging information among the economic units regarding their components of the environment in order to reach an agreement about an economic program for implementation. The informationally decentralized adjustment is shown to be external and anonymous. Furthermore, this process is Pareto-satisfactory since it is single valued, nonwasteful or Pareto-optimal and unbiased. This paper is relevant for water studies concerned with the theoretical basis of welfare analysis as it may apply to problems in water resource allocation. (Siegenthaler-Rutgers)
W71-02631

FACILITY PLANNING FOR A PUBLIC SERVICE SYSTEM: DOMESTIC SOLID WASTE COLLECTION,
University of Southern California, Los Angeles. Dept. of Urban and Regional Planning.
George P. Schultz.
Journal of Regional Science, Vol 9, No 2, p 291-307, August 1969.

Descriptors: *Decision making, Cost function, Bay, Solid waste system, Linear programing, Average cost.
Identifiers: *Facility planning, Collection cost, Planning period.

This paper develops a decision model for planning transfer stations used in an indirect haul system for domestic solid waste collection service. The objective is to minimize long run average cost per household subject to the constraint that a given quantity and quality of service be maintained. The model proposed allows for planning a new set of facilities and for the expansion of present facility capacity. The cost functions are estimated as well as the choice of values for the decision variable. The decision model is further subgrouped into submodels dealing separately with size, location and timing. The first submodel establishes facility capacity and service area for a hypothetical city. The second model distributes these facilities over the city and minimizes collection costs. The third submodel defines the optimal capacity increment and time interval for one facility serving an area having a linear population growth function. The techniques of this study may prove applicable to water waste disposal problems. (Siegenthaler-Rutgers)
W71-02632

A RECURSIVE PROGRAMING FOR NONSTRUCTURAL FLOOD DAMAGE CONTROL,
Arizona Univ., Tucson.
John C. Day.
Water Resource Research, Vol 6, No 5, p 126 1271, October 1970.

Descriptors: *Land use management, *Econon efficiency, Economic rent, Constraint, Benefit-c analysis.
Identifiers: *Floodplain land use, *Recursive p graming, Objective function, Payoff, Present valu

Flood control projects such as levees, channel i provements, and reservoirs are no longer adequ methods for the prevention of flood damage a losses. This paper considers a floodplain land u management or nonstructural approach to urb land damage control. The model discussed enab nonstructural alternatives such as spatial planni site elevation and flood proofing to be evaluated a common basis with structural measures. T model developed uses recursive linear programi for allocating specific land uses to specific parts the floodplain. Alternative land uses which empl various levels of land fill and flood proofing evaluated according to the economic value a co munity gains from its lands. As a planning to given aggregate land use requirements, the mo evaluates nonstructural alternatives in terms their economic feasibility and effects on econon rents. Optimal land use activities are then select for various planning periods. This model is relev for water resource planners involved with floo plain management. (Siegenthaler-Rutgers)
W71-02646

PROVISIONAL 1967 COLORADO INPUT-OUPUT STUDY,
Colorado State Univ., Fort Collins. Dept. Economics.
For primary bibliographic entry see Field 06B.
W71-02649

6B. Evaluation Process

POTOMAC-SHENANDOAH RIVER BAS COMPREHENSIVE WATER RESOURC PLAN: VOLUME 5-ENGINEERING DEVELO MENT ALTERNATIVES.
Virginia Dept. of Conservation and Econor Development, Richmond. Div. of Wa Resources.

Virginia Division of Water Resources Planning B letin 221, August 1970. 452 p, 109 plate, 108 tab append.

Descriptors: *Water resources, *Manageme *Planning, Reservoirs, Statistical metho Watershed management, Flood control, Wa treatment, Recreation facilities, Erosion cont Sediment control, Water demand, Cost analy *Virginia.
Identifiers: Potomac-Shenandoah River ba (Va).

This is the fifth in a series of six volumes which c tains a plan for development of the water resour of the Potomac-Shenandoah River basin in V ginia. Various elements of water resour development and management which may fu the basin needs now and in the future are amined. Costs which will be associated with vari water quality standards in the basin are analyz Areas where conflicting demands on the wa resource may occur are pointed out. There varying degrees of detail for different areas in basin due to the wide variety both of technical d and in the urgency of required solutions. Reserv mass curves, tables, and maps are includ (Woodard-USGS)
W71-02216

METROPOLITAN PLANNING GUIDELIN SEWAGE TREATMENT (FACILITIES).
Northeastern Illinois Planning Commissi Chicago, Illinois.
For primary bibliographic entry see Field 05D.
W71-02284

A COMPARATIVE ANALYSIS OF AMERICAN AND CANADIAN GOVERNMENTAL ARRANGEMENTS FOR THE DEVELOPMENT OF REGIONAL WATER POLICY IN THE COLUMBIA RIVER BASIN,
Washington Univ., Seattle. Dept. of Political Science.
For primary bibliographic entry see Field 06E.
W71-02499

A COMPREHENSIVE APPROACH FOR INDIA'S WATER RESOURCES DEVELOPMENT,
Nevada Univ., Reno. Desert Research Inst.
Dinesh C. Sharma.
Annals of Arid Zone, Vol 9, No 1, p 1-9, March 1970. 4 fig, 6 ref.

Descriptors: *Water resources development, *Groundwater, *Regional analysis, *Administration, *Planning, Water supply, Water conservation, Systems analysis, Groundwater basins, Hydrologic budget, Surface waters, Economic efficiency, Estimated benefits, Estimated costs, Programs, Agriculture, Data collections, Irrigation practices, Hydrogeology, Analytical techniques, Water utilization.
Identifiers: *India.

Agricultural activities in India produce one-half the national income and employ three-fourths of the working class. A fundamental fact of life in India is the low per acre yield because of poor soil management practices and ignorance of modern techniques. Due to low, unpredictable rainfall, a large part of the country is designated marginal for agriculture. High efficiencies in conservation and use of water are crucial in these areas. Surface water supplies have been heavily utilized and the only possible improvements will involve more careful management for optimal utilization. For a number of reasons, groundwater supplies have been largely unutilized, although they offer the only other important water source during monsoon failure. The advantages and disadvantages of groundwater are discussed and it is felt that India may conveniently be divided into 5 regions for the purpose of undertaking a national regional groundwater survey with the purpose of locating and developing reliable groundwater supplies. A 5-phase program is outlined, organized around groundwater-flow systems analyses and efficient administrative organization. Tentative organizational flow charts are presented. (Casey-Arizona)
W71-02511

HOW GREEN IS THE GREEN REVOLUTION,
William C. Paddock.
BioScience, Vol 20, No 16, p 897-902, 15 August 1970. 15 ref.

Descriptors: *Water costs, *Irrigation programs, *Economic efficiency, *Economic impact, *Grains (Crops), Financing, Weather, Cost-benefit analysis, Cost transfer, Economic feasibility, Economic prediction, Arid lands, Tropical regions, Water allocation (Policy), Water resources, Water utilization, Water values, Water yield, Crop production, Political aspects, Population, Social impact, Social values, Wheat, Rice, Rainfall, Mexico, Agriculture.
Identifiers: *High-yield varieties, *Over population problems, *Green Revolution, *Under-developed countries, *Agricultural subsidies, Phillipines, India, Asia.

The author argues that the existence of a Green Revolution in the underdeveloped world is largely an illusion. The years of greatest success of the so-called Green Revolution (1967-1969) coincided with a period of unusually high rainfall in Asia and increases in production would have occurred with or without new technology. Only 2 high-yield crops have actually been developed: wheat and rice. Social factors in Asian countries militate against wheat, and rice yields have stagnated after early increases. Further, excessive concentration upon a limited number of varieties is decreasing the available gene pools of these crops, with unquestionable future adverse affects. Where yield increase success has occurred, it has been facilitated by increased inputs of high-cost irrigation water and fertilizers. These uneconomic applications to relatively low value crops have resulted from government subsidies to these sectors, removing them from marketplace discipline. They are essentially internal transfer payments adding to national debt load and constitute little or no overall increase in national production. It is felt that for political reasons, 2 critical problems will result from the Green Revolution illusion: (1) lessened government concentration in the agricultural sector and (2) avoidance of facing the most crucial problem of all -- overpopulation. (Casey-Arizona)
W71-02513

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: STORM WATER RUNOFF AND DRAINAGE FACILITIES.
Mercer County Planning Board, Trenton, N.J.
For primary bibliographic entry see Field 04A.
W71-02602

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME I,
Gulf Universities Research Corp., Galveston, Tex.
For primary bibliographic entry see Field 02L.
W71-02606

A STUDY OF ECONOMIC VALUE OF INCREASED ESSA SERVICES AS RELATED TO ESTUARINE DYNAMICS IN GULF COAST ESTUARIES, VOLUME II, APPENDICES,
Gulf Universities Research Corp., Galveston, Tex.
For primary bibliographic entry see Field 02L.
W71-02607

REGIONAL WATER AND SEWERAGE FACILITIES PLAN 1990.
Indian Nations Council of Governments, Tulsa, Okla.
For primary bibliographic entry see Field 05D.
W71-02611

SOME ECONOMIC PLANNING CONSIDERATIONS OF GROUNDWATER POLLUTION FOR THE UPPER PAWCATUCK RIVER BASIN IN RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Economic Planning and Regional Development.
For primary bibliographic entry see Field 05G.
W71-02628

ADVANCE PLANNING SUCCESS IN CHICAGO,
Chicago Dept. of Water and Sewers, Ill.
James W. Jardine, and Louis R. Howson.
Journal American Water Works Association, Vol 62, No 7, p 397-399, July 1970. 1 tab.

Descriptors: *Long term planning, *Future planning (Projected), *Estimated costs, Construction costs, Project planning, Estimating, Forecasting, Utilities, Water resources development, Cities, Water resources, Planning, Illinois.
Identifiers: *Chicago Water Works, Chicago.

Advance planning is important in determining a construction schedule which will expand and maintain water resources facilities to meet increasing demands at the lowest possible cost. The City of Chicago has predicted the expenditure of $370 million (1969 price level) for new construction over the thirty year period 1969 - 2000. The magnitude of this figure justifies the careful survey of past, present, and future water requirements. Future water requirements, will reflect the growth of population in Chicago and a slight increase in per capita consumption. Long range planning must then be based on these factors and must also include a determination of areas in which water requirements will increase most. Very great savings have been accomplished through waste control in the system, and on the premises of the consumers. Waste control has decreased the amount of water lost to such an extent that the pumping requirements to the system have not increased significantly in spite of substantial ppulation growth. The average yearly expenditure for renewal and replacement of equipment over the next 30 years is estimated at $7.7 million, or 1.5% of the total investment in the Chicago Water Works. Currently the average family pays $37.50 per year for water, while metered customers pay $.275 per thousand gallons. (Hewett-Rutgers)
W71-02630

PRIVATE GOOD, EXTERNALITY, PUBLIC GOOD,
Glasgow Univ. (Scotland).
Alan W. Evans.
Scottish Journal of Political Economy, Vol XVII, No 1, p 79-89, February 1970.

Descriptors: *Welfare economics, Marginal utility demand curve, Flood control.
Identifiers: *Public good, *Externality, Pareto optimality, Social welfare function, Semi-public good, Private good, Consumption externality.

The purpose of this paper is to demonstrate that the welfare conditions for a public good are a special case of the welfare conditions for a consumption externality. A public good is defined (according to Samuelson in 1958) as a good which all enjoy in common so that each individual's consumption of such a good leads to no subtraction from any one else's consumption of that good. The welfare conditions for goods with external effects are derived. The optimality conditions for an ordinary externality are identical with the optimality conditions for a public good only when the good is consumed by only one person in the economy, the other consumers bearing the external effects. Since there is a distinction between public goods and goods with consumption externality, the terminology should be preserved for ease of classification. This article provides a general theoretical background for water studies concerned with the public-good aspects of water resource development. (Seigenthaler-Rutgers)
W71-02633

BENEFIT-COST ANALYSIS AND DEMAND CURVES FOR PUBLIC GOODS,
Princeton Univ., N.J.
David F. Bradford.
Kyklos, Vol XXIII, Fasc 4, p 775-790, 1970.

Descriptors: *Demand, *Optimization, *Social aspects, Economic evaluation, Economic efficiency, Cost-benefit analysis, Decision-making, Spillovers, Marginal cost, Production, Government, Welfare economics.
Identifiers: *Public goods, *Aggregate bid curve, Pareto optimality, Externalities, Individual preferences.

This study is concerned with the problem of ascertaining the demand curve for public water resource investments. The author suggests the use of total quantities rather than averages in the analysis of public goods. He discusses the use of a demand curve construction, which he calls an aggregate bid curve. This is a device which builds upon the intuitive notion of bargaining to reach a collective decision. It has the advantage of making the potential gains from trade evident in movements towards a Pareto optimal level of public goods provision. It also clearly distinguishes the concept of a benefit in benefit-cost analysis. The author demonstrates that all of the conditions of efficiency, even in the presence of public goods and externalities can be derived with this formulation of the demand function. (Murphy-Rutgers)
W71-02636

DILEMMAS OF ECONOMIC BEHAVIOR VIS-A-VIS ENVIRONMENTAL POLLUTION,
Vienna Univ. (Austria).
Robert Reichardt.
Kyklos, Vol XXIII, No 4, p 849-865, 1970.

Descriptors: *Environmental pollution, Cutical path method, Cost, Risk.
Identifiers: *Public consumption good, Ecosystem, Time-preference, Income redistribution, Game theory, Payoff.

This article considers the reasons for the delays in improving the human environment. The author discussed the following topics: the measurement of environmental quality, its symbolic appeal, the structure of possible actions and conflicting economic motivations with respect to the environment. The measurement of environmental quality, a public consumption good, is difficult because of differences in perception, adaptation, and time preference. The Critical Path Method, a management technique, is applied to an example of a lake threatened by water pollution in order to demonstrate the necessary actions to solve the problem. Conflicting economic motivations toward environmental pollution are analyzed through economic roles or vested interests and attitudes toward environmental change. Among the roles discussed are that of the polluting consumer, the polluting producer, the anti-pollution device producer, and the government. There are conflicts between and within the roles as well as time preference differences. There is a bargaining process where each role-holder tries to maximize his own utility with respect to antipollution legislation and imposes social costs on other agents. Game theory and public expenditure theory are used in the analysis of conflict. A necessary condition for cooperative action is that some agents be involved in altruistic behavior. (Siegenthaler-Rutgers)
W71-02637

THE GENERAL RELATION OF TECHNOLOGIC CHANGE TO EFFICIENCY IN WATER DEVELOPMENT AND WATER MANAGEMENT,
Carnegie Institution of Washington, D.C.
Edward A. Ackerman.
In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, p 450-467, 1965.

Descriptors: *Technology, *Water resource development, *Water supply, Management, Water demand, Economic feasibility, Planning, Multiple-purpose projects, Operations-research, Meteorology, Economic evaluation, Water quality, Chemical wastes, Aquifers, Conservations, Evaporation, Desalination.
Identifiers: Nuclear explosives.

This report examines the means which may be made available for increasing the efficiency of water supply use for whatever specific objectives which may be chosen by Congress. The author presents those aspects of new technology related to future water resource development. The different alternatives are evaluated in terms of their applicability to specific purposes and regions, the economic feasibility in relation to the water supply and water savings, and the present state of development. The techniques discussed are those relating to the planning, design, construction and operation of systems of multiple-purpose works; the exploration for, discovery and exploitation of new supplies; the measures for conservation and reduction of demand, and the treatment and use of waters having substandard quality. (Murphy-Rutgers)
W71-02638

REGIONAL PLANNING AND FLOOD PLAIN MANAGEMENT,
Pennsylvania State Planning Board, Harrisburg.
Irving Hand.
In: Proceedings of the Fourth American Water Resources Conference, New York, p 241-254, November 18-22, 1968.

Descriptors: *Flood plains, *Management, *Flood control, Non-structural alternatives, Flood plain zoning, Flood damage, Costs, Regional analysis, Planning, Government, Land use, Government.
Identifiers: *Flood plain management, *Pennsylvania Act 442, Subdivision, Building codes.

The author examines the developments relating to the need for concern with flood plain management and the various agencies which have been involved in dealing with these issues. The continuing presence of large flood damage costs emphasizes the need for controling development in flood plain areas. This should be the function of the regional planning agency. The author considers such possible non-structural measures available to implement plans for flood plain management as zoning, subdivision regulation, building and construction codes and the reservation of certain areas for future public acquisition. These are evaluated in terms of their feasibility and effectiveness. (Murphy-Rutgers)
W71-02640

REGULATION AND THE FREE MARKET: THE PROBLEM OF BOUNDARIES,
Vanderbilt Univ., Nashville, Tenn. Dept. of Economics.
James W. McKie.
The Bell Journal of Economics and Management Science Vol 1, No 1, p 6-26, Spring 1970.

Descriptors: *Public utilities, *Prices, *Costs, *Welfare economics, Optimization, Rate of return, Marginal cost, Competition, Resource allocation, Economic evaluation, Regulation, Government, Value, Economic efficiency, Spillover, Capital cost, Management.
Identifiers: Electric utilities, Rate discrimination, Value of Service, Boundaries.

This paper deals with the problem of utility pricing and external limits to the regulated activities of public utilities in a competitive environment. The problem of correct pricing procedures and limits on the growth of water utilities may be clarified by this article. The author shows that as long as a utility is relatively isolated and self-contained its pricing problems are relatively simple and the system is satisfactory from the point of view of economic welfare as long as it fulfills the marginal conditions. However, a boundary problem appears whenever regulated activities are intermingled with non-regulated ones or when public utilities compete with each other or with unregulated industries, or where technological innovation and new forms of organization lead to new kinds of activities for the public utility. The paper demonstrates that this may distort the attainable degrees of discrimination, customer classifications, the internal structure of profit margins, the stability of prices, and the rate of return and lead to the condition of pricing below marginal cost. (Murphy-Rutgers)
W71-02642

RECREATION DEMAND FUNCTIONS AND THE IDENTIFICATION PROBLEM,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Economics.
Robert J. Kalter, and Lois E. Gosse.
Journal of Leisure Research, Vol 2, No 1, p 43-53, Winter 1970.

Descriptors: *Recreation demand, *Decision making, Time series analysis, Cross section, Forecasting, Resource allocation, Economic efficiency, Cost-benefit analysis, Elasticity of demand.
Identifiers: **Identification problem, *Structural demand, Reduced form equation, User response model, Econometrics, Equity, Consumer surplus.

This paper considers the identification problem of demand equations in the study of outdoor recreation. Improper accounting of demand and supply can lead to projections of supply imbalances. One approach to this problem is to use reduced form equations and user response models. These models assume that the effect on use of a given increase in facilities is constant regardless of the magnitude
location of such an increase. These models do n
yield a true recreation demand estimate and resu
in another identification problem. The identific
tion problem has been linked to the use of time s
ries data and reliance on site-oriented recreati
demand studies. The authors stress the importan
of the structural demand equation approach for o
taining estimates of the economic value of recre
tion for use in public decision-making. A soluti
to the identification problem is presented with t
suggestion that individual cross section data
used to estimate a traditional market type
recreation demand equation rather than a si
specific function. The cost of the entire recre
tional experience should be used as the price var
ble. The authors claim that the special nature
costs associated with participation in outdo
recreational activities and the spatial distribution
recreation facilities make this model feasible. T
article is relevant to studies concerned with estim
tion water-oriented recreation dema
(Siegenthaler-Rutgers)
W71-02643

ECONOMIC OPTIMIZATION AND RESE VOIR RECREATION,
Kentucky Univ., Lexington. Dept. of Civil E
gineering.
L. Douglas James.
Journal of Leisure Research, Vol 2, No 1, p 16-2
Winter 1970.

Descriptors: *Recreation reservoir, *Margi
benefit, Marginal cost, Gravity model, Cost-bene
analysis.
Identifiers: *Economic optimization, Psychologi
capacity.

In determining optimum project size, plann
choose the size that maximizes benefits net of cos
With respect to a reservoir recreation facility, i
difficult to apply marginal economic analy
because of the difficulty in estimating visitation t
larger facility. In the past, planners used previo
experience to determine the size of the propos
reservoir or a total benefit approach. However,
have an optimum size, marginal benefits must
calculated before they can be compared to m
ginal cost. The procedure presented provides
means for estimating visitation as a function of p
vided visitor capacity required to derive the m
ginal benefit curve. Visitation data are collec
from existing reservoirs in a similar environment
find reservoir capacity for visitors and to estim
the effect of capacity on annual visitations. T
author advises planners to evaluate the necessa
empirical coefficients from locally applicable da
(Siegenthaler-Rutgers)
W71-02648

PROVISIONAL 1967 COLORADO INPUT-OU PUT STUDY,
Colorado State Univ., Fort Collins. Dept.
Economics.
Clyde R. Smith.
M.S. Thesis, August 1970. 41 p, 8 tab, 1 fig, 41 re

Descriptors: *Input-output analysis, *Resource
location, Mathematical model, Industrial prod
tion.
Identifiers: *Interindustry approach, *Transacti
matrix, Output multiplier, Payment sector, Dir
coefficient, Indirect coefficient, Exogenous.

This thesis examines the economic interrelati
ships of Colorado's economy using input-outp
analysis. This study builds a provisional input-o
put model of Colorado for the year 1967 wh
describes the intra- and-intersectoral flow of goo
and services in Colorado's economy. For the ana
sis, the economy of Colorado was divided into
teen processing or producing sectors and one
ogenous sector. Sectors were chosen on the basis
available secondary data and the importance
water to the sector. An aggregated 1963 Uni
States transactions table for these sectors w

developed. Given this table, the United States direct coefficients were determined as well as the indirect coefficients and output multipliers. It was assumed that Colorado's technical or direct coefficients correspond identically to those of the United States. Given this assumption, it was possible to derive a transactions table for Colorado. However, because of the lack of primary data available for Colorado, the author concluded that the transaction table was not entirely reliable but magnitude references of an ordinal nature are possible. The author believes this study will prove useful in the determination of a more refined input-output analysis for Colorado. (Siegenthaler-Rutgers)
W71-02649

A SUMMARY ANALYSIS OF NINETEEN TESTS OF PROPOSED EVALUATION PROCEDURES ON SELECTED WATER AND LAND RESOURCE PROJECTS.
Water Resources Council, Washington, D.C.

Report to the Water Resources Council by the Special Task Force, July 1970. 226 p, 7 tab, 4 chart.

Descriptors: *Water resources development, Water management, Planning.
Identifiers: *Water resources planning, Comprehensive planning.

The Report to the Water Resources Council by the Special Task Force includes a summary analysis of 19 tests of proposed evaluation procedures on selected water and land resource projects. The tests pointed up many areas in the report of June 1969, where ambiguities existed and further clarification was required. Further, the test results substantiated that the June report was concerned primarily with concepts and included only a few standards and procedures to implement them. Much of the testing effort was directed toward the development of standards and procedures to implement the concepts. In several tests, the teams explored alternative concepts departing from those presented in the June report. The tests have indicated that multiobjective planning is practical. Emphasis is placed on (1) measurement of plan impacts in terms of benefits and costs; and (2) formulation of alternative plans emphasizing the several national objectives. (Wray-Chicago)
W71-02664

STANDARDS FOR PLANNING WATER AND LAND RESOURCES.
Water Resources Council, Washington, D.C.

A Report to the Water Resources Council by the Special Task Force, Washington, D.C., July 1970. 299 p, 1 fig, 8 tab, 2 charts, 3 maps, 1 append.

Descriptors: *Water resources, *Land Resources, *Planning, *Standards, Methodology, Benefits, Costs, Evaluation, Formulation, Coordination, Cost allocation, Cost sharing.
Identifiers: *Water resources planning, Objectives, System of accounts.

These standards for water and land resource planning are a portion of a Water Resources Council study which proposes a set of principles, standards, and procedures for water and land resource planning. The principles provide the broad policy framework for planning activities and include the conceptual or theoretical basis for planning. The standards provide uniformity and consistency by comparing, measuring and judging benefits, costs, and alternatives. The procedures provide the methods for carrying out the various levels of planning activities, including the selection of objectives, measurement of benefits and costs, and comparison of alternate courses of action. The following topics are considered in the Standards: objectives; benefits and costs; general evaluation standards; plan formulation; a system of accounts; cost allocation, reimbursement, and cost sharing; a national program for Federal and Federally assisted activities; and the coordination and review of planning studies. (See also W71-02666) (Davis-Chicago)
W71-02665

PRINCIPLES FOR PLANNING WATER AND LAND RESOURCES.
Water Resources Council, Washington, D.C.

Report to the Water Resources Council by the Special Task Force, July 1970. 25 p.

Descriptors: *Water resources development, Water policy, *Planning, Decision-making.
Identifiers: *Water resources planning, Comprehensive planning.

The principles for planning water and land resources, together with Standards and Procedures, provide the basis for Federal participation with states and others in Federal and Federally assisted water and land resource projects. Multiobjective planning is stressed to improve the public decision-making process. The four main planning objectives are: (a) national economic development, (b) enhancement of quality of environment, (c) social well-being, (d) regional development. Benefits and costs are considered as they affect the objectives; benefits are positive contributions toward accomplishment and costs are negative. General Evaluation Principles include measurement of benefits and costs, price relationships, consideration of alternatives, scheduling, risk and uncertainty, and updating plans. Planning for water and land resources should be carefully related to other regional planning. Alternative plans of tradeoffs among significant conflicting objectives. A plan will be selected only if the total benefits (monetary and nonmonetary) to all objectives are equal to or exceed the total costs to all objectives. A system of accounts will be established that displays benefits and costs of each plan to the multiobjectives. Reimbursement and cost-sharing policies shall be directed to the end that identifiable beneficiaries bear an equitable share of costs commensurate with benefits received. (See also W71-02665) (Wray-Chicago)
W71-02666

THE SALT RIVER PROJECT OF ARIZONA: ITS ORGANIZATION AND INTEGRATION WITH THE COMMUNITY,
Arizona Univ., Tuscon.
Courtland L. Smith.
Master's Thesis University of Arizona, 1968. 298 p, 12 fig, 18 tab. OWRR B-003-ARIZ (2).

Descriptors: *Urbanization, *Electric power, *Water users, *Decision making, *Social aspects, *Economics, *Legal aspects, Technology, Arizona.
Identifiers: *Salt River Project, National Irrigation Act of 1902.

The Salt River Project is studied in terms of its adaption to rapid urbanization. Discussed here are laws and conventions embodied in the reclamation principle, which provides for the allocation of power revenues to reduce the cost of water to land owners. Charges to water users have decreased in the past thirty years with increased numbers of electric customers, increased electric customer usage and improved efficiency of the power system. Changes which have occurred in the transfer of water from farm to urban uses are enumerated. The project, it is indicated, has tended to accept the requirements of water users while adjusting its technical, economic, legal and social ability in order to continue the distribution of an adequate supply of low cost water. With population increases since World War II, the project has developed programs to educate the public about its activities and objectives; but it is still faced with the decision as to what role the urban public is to take in the decision making practice. A linked set of hypotheses has been developed to explain the project's adaption to urbanization. From this set, the effect of different degrees of disorganization, secularization and individualization can be assessed in relation to the change in the distribution of water with respect to position and the change in position in a social organization with increased numbers of participants. Methods for this study derive from the suggestions of Redfield in The Little Community and the systems concept. Social system components, elements external to the system, and data necessary to describe a social system are discussed. (Preckwinkle-Chicago)
W71-02667

ECONOMICS AND ENVIRONMENTAL IMPACTS OF INCREASING LEISURE ACTIVITIES,
Resources for the Future, Inc., Washington, D.C.
Marion Clawson.
In: Future Environments of North Amaerica, ed. Darling, F. Fraser and Milton, John P., The Natural History Press: Garden City, New York, 1966, p 246. 2 fig, 1 tab, 3 ref.

Descriptors: *Recreation, *Time, *Income, Planning, Urbanization, Seasonal, Environment.
Identifiers: *Leisure, *Anticipation, *Travel, *Recollection, *Psychic environment, Space.

The author contends that the real wealth of a nation is the time of its members: very few studies have been made of it. Leisure, defined here as discretionary time above that needed for the basic subsistence requirements of man, is distinguished from mere idleness in which an individual does not know or is unable to do anything he wishes. Further distinction is seen between leisure and recreation; while leisure is basically a time oriented concept, recreation is a personal experience concept or activity. Similarities are observed between leisure and discretionary income; total amount of leisure, timing and size of its pieces, and its uses are noted as depending largely upon the phase of the individual life cycle. Included is a national time budget and time-division of leisure for 1900, 1950, and projected for 2000. Four major kinds of leisure are evident: Daily, Weekend, Annual, and retirement. With increases in leisure time expected, it is important to consider how each kind will be allotted. Discussion of outdoor recreation as a use of leisure involves a threefold, classification: user-oriented areas, close to where people live, intermediate use areas, designed primarily for day long recreation, and resource based areas more suited to vacation time. Five distinct phases of the recreation experience are outlined and discussed: anticipation, travel to the site, on-site experiences, travel back, and recollection. Discussed also are aspects such as seasonality, space-peaking, impacts on natural environment, and impact on the psychic environment e.g., privacy or solitude. Possible consequences of more leisure are discussed: greater emphasis on consumption and availability of time, and a greater urban dominated society with more urban leisure are considered. (Preckwinkle-Chicago)
W71-02670

TECHNOLOGY, RESOURCES AND URBANISM--THE LONG VIEW,
Michigan Univ., Ann Arbor. School of Natural Resources.
Richard L. Meier.
In: Future Environments of North America, ed Darling, Fraser F. and Milton, John P., The Natural History Press, Garden City, New York, 1966, p 277-288. 16 ref.

Descriptors: *Resource development, *Communication, *Information retrieval, *Technology, *Research facilities, Population, Conservation.
Identifiers: *North America, South Asia, Houseboats.

The author asserts that a new set of insights will reconstruct the outlook for natural resources from nature-centered adaptive policies to urban interests. According to this new view, technology is a means for applying communicable knowledge to the environment (physical, biological, social) so as to produce valuable goods and services. As

knowledge continues to accumulate, the control over unwanted changes in the natural environment will increase. In the United States, it is indicated, no resource scarcity is critical enough to threaten development of the economy during the twentieth century. And by implication, no habitat is in danger due to crises of scarcity. Communicable knowledge enables forecasting to utilize expanding scientific studies and potentiality for substitutes for critical commodities. Materials and energy resources are reviewed for the various regions of North America. And attention is devoted to problems of water and land scarcity. One suggestion is that houseboats may reduce population density; optimism is also given for meteorological advances. Demands for living space while not critical in North America are in South Asia and the author indicates that this could seriously effect North American urbanization. It is contended that cities provide the best locus for human resources development. Cities that develop and grow, generating wealth and attracting the energetic individuals, are built and organized so that human capital is conserved and expanded. It is in the cities that one finds the best storage of information. Research, by piling up evidence and translating it into technological practices, has proven to be the most effective means for obtaining returns from resources. (Preckwinkle-Chicago)
W71-02671

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

RYAN V COMM'RS OF WATER DIST NO 1 (NOTICE REQUIRED FOR VALID ASSESSMENT BY WATER DISTRICT).
For primary bibliographic entry see Field 06E.
W71-02361

BUDGETARY CAPITAL COST ESTIMATES OF 1- TO 10-MGD MULTISTAGE FLASH DISTILLATION PLANTS FOR DESALTING SEAWATER,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03A.
W71-02609

RATE MAKING POLICIES AND PRACTICES OF PUBLICLY OWNED WATER UTILITIES,
Florida Univ., Gainesville. Dept. of Economics.
Norman G. Keig, Charles W. Fristoe, and Frederick O. Goddard.
Journal American Water Works Association, Vol 62, No 7, p 425-430, July 1970. 11 tab.

Descriptors: *Water rates, Public utilities, Water costs, Pricing, Cost analysis, Cost allocation, Cost sharing, Costs, Depreciation, Utilities.
Identifiers: *Rate making, Rate schedules, Cost classification.

This article describes various rate making policies and practices of selected publicly owned water utilities, and discusses the degree to which accepted rate making policies are followed. Two widely used bases for determining revenues which are discussed are the 'utility' basis and the 'cash' basis. Various practices which are examined are: the depreciation of facilities, the use of current funds for minor improvements, the use of reserve funds for major improvements, payment of local taxes, contribution to general municipal funds, free public water service, and free fire protection service. The classification of costs on either a demand basis or a functional cost basis, and the classification of customers into special groups are discussed. Four bases for rate schedules are presented and preferences for each type are discussed in relation to the questionnaire data. It was concluded that utilities practice and advocate the collection of sufficient revenue to be self-supporting. Most utilities pay for minor improvements from current funds and depreciate their facilities. A majority of the utilities use the cash method for determining revenues, but a significant number favor the utility method. The creation of reserve funds for major improvements is not often practiced, but is widely advocated. The functional method for classifying costs is more widely practiced than advocated. (Hewett-Rutgers)
W71-02629

THE WELFARE EFFECTS OF ZERO PRICING ON PUBLIC GOODS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Economics.
Joseph J. Seneca.
Public Choice, Vol VIII, No 2, p 101-110, Spring 1970.

Descriptors: *Social welfare, Marginal cost, Elasticity, Costs.
Identifiers: *Public good, *Zero pricing, Capacity constraint, Excess demand, Consumer surplus.

Certain public goods such as outdoor recreation have a zero user price because of equity considerations and pricing difficulties. Moreover, these goods are characterized by capacity constraints with the result of excess demand which leads to the rationing of available output. This paper considers the social welfare implications of the capacity constraints and non-price rationing of the public goods. It is shown that if a good is actually priced at long run marginal cost or zero, and there is excess demand, the welfare measures of the discriminating monopolist approach or short run marginal cost pricing overstate the true welfare measure at capacity. If short run marginal cost rises before capacity is reached with zero prices, then situations can exist where welfare can be increased by allowing full capacity utilization even though a quantity restriction based on a shadow short run marginal cost pricing policy would indicate otherwise. This discussion is relevant for water resource planners concerned with congestion and pricing problems. (Siegenthaler-Rutgers)
W71-02635

A MATHEMATICAL FORMULATION OF THE PEAK-LOAD PRICING PROBLEM,
Polytechnic Inst. of Brooklyn, N.Y.
Israel Pressman.
Bell Journal of Economics and Management Science, Vol 1, No 2, p 304-326, Autumn 1970.

Descriptors: *Optimization, Net benefits, Discriminatory pricing, Elasticity of demand.
Identifiers: *Peak-load pricing, Consumer surplus, Producer surplus, Dependent demand, Line integration, Capacity constraint, Profit constraint, Lagrangian multiplier, Marginal capacity cost, Marginal operating cost.

This paper develops mathematical models useful in analyzing the public utility peak-load pricing problem. The objective of the firm is to maximize social satisfaction from services provided. Mathematically, the firm's objective is expressed by maximizing the net benefit (i.e., the consumer surplus plus the producer surplus). The consumer surplus concept is extended to multidimensions to allow for periods where demand functions are both independent and dependent by using the line integral calculus. Demand is said to be dependent when price depends on the quantities of more than one service. The actual objective in the models is to maximize net benefit in a multi-period framework where demands are different for every period and subject to profit and capacity constraints. Peak-load pricing models with profit constraint show that prices depend on marginal operating costs but not on marginal capacity costs. With active profit constraints, price is dependent on the demand elasticities for independent demand but for dependent demand the cross elasticity is relevant also. For capacity constraint models, prices are charged according to marginal cost pricing principles. For both profit and capacity constraint models, prices depend on the marginal cost and demand elasticity. The article is important for water studies concerned with the theoretical foundations of pricing policies. (Siegenthaler-Rutgers)
W71-02641

A NOTE ON COST-BENEFIT ANALYSIS OF INVESTMENTS IN INTERMEDIATE PRODUCTS,
Stockholm Univ. (Sweden).
Leif Magnusson.
Swedish Journal of Economics, Vol 72, No 3, p 215-218, September 1970.

Descriptors: *Cost-benefit analysis, Marginal cost, Economic efficiency, Investment, Equilibrium.
Identifiers: *Intermediate product, Consumer surplus, Producer surplus, Capital good.

The author considers the application of cost-benefit analysis to investments in intermediate products. Intermediate products are capital goods which are used in the production of goods for final consumption. The consumers' willingness to pay for the consumer product can be measured by the area under the compensated demand curve for the capital product in question. However, if price variations occur in consumer product markets, corrections of the investment criterion must be made on the basis of an estimate of the resulting consumers' and producers' gains and losses on the consumer good market. An example of an investment in an irrigation project is given with the maximum willingness to pay for the project measured by the value of the increased supply of irrigation water at ex-post price and consumers' and producers' surplus on the consumer good market under the conditions that all prices are relatively constant and equal to marginal cost. More generally, it is found that an estimate from the market for the intermediate product will, under the above conditions, lead to a correct estimate of the willingness to pay. This article is of interest to water resource planners concerned with the evaluation of prospective projects. (Siegenthaler-Rutgers)
W71-02645

SOME PROBLEMS OF PRICING UNDER STOCHASTIC SUPPLY CONDITIONS: THE CASE OF SEASONAL PRICING FOR WATER SUPPLY,
London Graduate School of Business Studies, London (England).
M. A. Crew, and G. Roberts.
Water Resources Research, Vol 6, No 5, p 1272-1276, October 1970.

Descriptors: *Stochastic processes, *Water supply, Risk, Probability, Constraint.
Identifiers: *Seasonal pricing, Consumer surplus, Social welfare function, Opportunity cost, Lagrangian analysis.

This paper considers some of the problems of seasonal pricing of the water supply with particular attention to the determination of optimal seasonal carryover in a fixed capacity system and optimal pricing in the face of stochastic supply. First, a simple supply model is given which yields optimal prices, carryover and capacity. This model has little direct application except when the variance in runoff is small due to the stochastic nature of water supply. Secondly, a stochastic model with stochastic supply and determinate demand is given with each year treated independently. For the summer period, welfare gain is maximized subject to maintenance of a certain security level of water in the reservoir. In practice, pricing is more complicated for the start of the winter because the impact on the following summer must be considered. Since the amount of security which is provided is determined by value judgment, the stochastic model in practice is complex since it is influenced by social choice. (Siegenthaler-Rutgers)
W71-02647

RELATIVE ECONOMICS OF ANIMAL WASTE DISPOSAL BY SELECTED WET AND DRY TECHNIQUES,
Resource Engineering Associates, Inc., Stamford, Conn.
For primary bibliographic entry see Field 05D.
W71-02743

6D. Water Demand

DAVISON V CITY OF ANN ARBOR (FAILURE OF PROOF THAT LOWERING OF WATER TABLE WAS DUE TO OTHER THAN NATURAL CAUSES).
For primary bibliographic entry see Field 06E.
W71-02378

ANDES V ANDES (WATER RIGHTS SUBJECT TO LEASEHOLD).
For primary bibliographic entry see Field 06E.
W71-02379

ESSEX CO V GIBSON (MEASUREMENT OF WATER RIGHTS FOR MILL USE).
For primary bibliographic entry see Field 06E.
W71-02528

STATE EX REL CRABBE V MIDDLETOWN HYDRAULIC CO (RESERVATION OF DIVERSION RIGHTS).
For primary bibliographic entry see Field 06E.
W71-02532

ADVANCE PLANNING SUCCESS IN CHICAGO,
Chicago Dept. of Water and Sewers, Ill.
For primary bibliographic entry see Field 06B.
W71-02630

6E. Water Law and Institutions

GOVERNMENTAL ADMINISTRATION OF WATER RESOURCES IN THE CHICAGO METROPOLITAN AREA.
Northeastern Illinois Metropolitan Area Planning Commission, Chicago.

Public Administration Service, Chicago, Ill., 1963. 92 p, 9 map, 8 tab, 5 append.

Descriptors: *Planning, *Water resources development, *Administration, *Coordination control, Financing, Water supply, Sewage disposal, Flood control, Drainage, Multiple-purpose projects, Federal government, State governments, Interstate, Cities, Legislation.
Identifiers: *Water resources management, Water resources research, Counties, Special districts.

Management of water resources in the Chicago metropolitan area is studied with emphasis on problems of coordination and cooperation among governmental jurisdictions. The work is intended to serve as guide and precedent for similar action in other urban complexes. At the same time water resources management in other states and metropolitan areas is reviewed in order to gain some insight into how this area's problems can be solved. The area is first described in terms of its population growth past and present, its number and types of local governments, and those state and federal agencies concerned with water resources. Next, water resource facilities are described and mapped with present or anticipated problems outlined. Discussed are water supply systems, sewerage systems, flood control and drainage and other water uses and facilities including multipurpose facilities. Planning research, development, and financing are discussed from all levels from federal activity to municipal activity with interstate activity and special districts included. Federal influence and State, County, and Municipal controls are described and water management operations reviewed. In order for management to be effective, coordination among all levels is necessary with consideration of the overall water resources picture. Present sources of policy determination, judgement of operational effectiveness and need for comprehensive reporting are pointed out. Recommendations are made regarding implementation needs, intergovernmental cooperation, planning and financing, and legislative action. All levels of government are included with discussion regarding those levels needing strengthening. (Preckwinkle-Chicago)
W71-02204

SHERIFF V CITY OF EASLEY (RIGHT TO FLOW OF UNCONTAMINATED STREAM THROUGH PRIVATE PROPERTY).

183 SW 311-318 (SC 1936).

Descriptors: *South Carolina, *Pollutants, *Condemnation, *Sewage treatment, Eminent domain, Treatment, Natural flow, Sewage, Damages, Real property, Land, Cities, Streams, Reasonable use, Land use, Pastures, Farms, Compensation, Effluents, Water pollution, Natural use, Sewage disposal, Sewage effluents, Legal aspects, Judicial decisions, Municipal wastes.

Plaintiff landowner brought action against defendant city for permanent damages to her real property. Defendant had discharged pollutants and sewage into a stream which ran through plaintiff's land. Plaintiff maintained that she was entitled to the uninhibited, pure, and natural flow of the stream which ran through her land. Plaintiff contended further that defendant had made an unreasonable use of the stream and had deprived her of the ordinary use of her land for farming, pasturage, and as a residential site. Plaintiff concluded such use by defendant had amounted to the taking of her property without compensation. Defendant city contended that the sewage in the stream had been treated adequately and that the effluent did not cause any injury or damages to plaintiff's land. The court found that defendant had polluted the stream, thereby depriving plaintiff of the ordinary and reasonable use of her property. The court stated that such action by defendant had amounted to the condemnation of plaintiff's land. Therefore, the court held defendant had a duty to make just compensation to plaintiff for the property so taken. (Finman-Florida)
W71-02273

OGUNQUIT BEACH DIST V PERKINS (LOW WATER MARK AS BOUNDARY OF PROPERTY ADJACENT TO THE OCEAN).
21 A2d 660-664 (Me 1941).

Descriptors: *Maine, *Boundary disputes, *Low water mark, *Caosts, Oceans, High water mark, Atlantic Ocean, Littoral, Boundaries (Property), Legal aspects, Shores, Judicial decisions, Relative rights, Real property.

Plaintiff brought action to recover a parcel of land claimed by defendant. The controversy centered around the location of the dividing line between plaintiff's and defendant's property. Plaintiff contended that properties in dispute, being adjacent to the Atlantic Ocean, were to be measured by considering the properties' eastern boundary as the low water mark of the ocean. Defendant contended that the properties' eastern boundary was the high water mark of the ocean. The court held that when the deed of property adjacent to the ocean designates a boundary as 'the see' or 'the ocean', then the boundary extends to the low water mark. Since plaintiff's deed contained such a designation, the trial court's judgment for defendant was reversed. (Snow-Florida)
W71-02274

APPLICATION OF GILLESPIE (COMPENSATION FOR DAMAGE CAUSED BY INCREASE IN VOLUME OF FLOW).
265 App Div 239, 38 NYS 2d 612-616 (App Div 1942).

Descriptors: *New York, *Eminent domain, *Compensation, *Flow augmentation, municipal water, Judicial decisions, Legal aspects, Condemnation value, Easements, Cities, Flow control, Railroads, Embankments, Water distribution (Applied), Engineering structures, Civil engineering, Industrial water, Aqueducts, Reservoirs, Damages, Channel erosion.

Pursuant to the acquisition of a right to increase the flow of a creek abutting respondent railroad's property, petitioners, members of the Board of Water Supply, conveyed reservoir water into the creek. The addition of such reservoir waters eroded the natural banks of the creek and respondent's railroad embankments. Respondent appealed the report of the Commissioners of Appraisal which fixed only a nominal award for damages to the railroad embankments. Petitioners contended the awards should be nominal because the necessary reinforcement of respondent's embankments against normal stream flow would take care of the insignificant damage caused by the induction of reservoir water into the creek. The court, in granting respondent's motion to set aside the Commissioners' report, held that the award for damages was not just compensation. The court reasoned that petitioners must bear the portion of such burden caused by the increase in volume of flow and that awards of nominal damages did not meet such requirement. (Powell-Florida)
W71-02295

CHELTENHAM AND ABINGTON SEWERAGE CO V PUBLIC SERVICE COMM'N (OWNERSHIP OF STORM DRAINAGE SYSTEM).
311 Pa 175, 166 A 649-652 (1933).

Descriptors: *Pennsylvania, *Storm drains, *Surface runoff, *Use rates, Natural streams, Storm runoff, Urbanization, Drainage systems, Sewers, Clay pipes, Tiles, Streams, Marshes, Administrative decisions, State governments, Rates, Judicial decisions, Legal aspects, Regulation, Supervisory control (Power).

Plaintiff sewerage company appealed an order of defendant Public Service Commission which denied plaintiff's request for permission to charge for storm drainage service. Plaintiff's predecessor had installed conduits in streambeds to form a storm drainage system for a subdivision. A sewerage system was also installed by plaintiff's predecessor, separately and disconnected from the storm drainage system. Defendant contended that plaintiff did not own the storm system. The court determined that a conveyance to plaintiff by the subdivision promoter included only the sewerage system, and that if the storm system had been included, charges could not be exacted for its use, since the storm system was merely a substitute for natural drains. Property owners have a right to use artificial conduits for drainage of surface waters formerly carried away by natural streams. Furthermore, the court noted that there was meager evidence of maintenance of the storm system or other indicia of ownership. The court held that plaintiff did not own the storm drainage system and consequently could not charge for its use. (Hart-Florida)
W71-02309

HARVEY REALTY CO V BOROUGH OF WALLINGFORD (RIPARIAN RIGHTS AND PROTECTION OF PUBLIC WATER SUPPLY).
150 A 60-64 (Conn 1930).

Descriptors: *Connecticut, *Riparian rights, *Water supply, *Water pollution, Watercourses (Legal), Water utilization, Water policy, Legal aspects, Judicial decisions, Condemnation, Ponds, Streams, Water quality, Public rights, Public health, Relative rights, Competing uses, Reasonable use, Usufructuary right, Damages, Administrative agencies, Reservoirs, Legislation, Water pollution control.

Plaintiff realty company sought damages and an injunction restraining defendant borough from interfering with plaintiff's sale of land, along with bathing privileges, in a pond used by defendant as a source of water supply. Defendant counterclaimed and sought to restrain plaintiff from rendering such

water unfit for supply purposes. The trial court found the pond to be a reservoir within the meaning of a statute which prohibited bathing in and polluting reservoirs. The Supreme Court of Errors of Connecticut affirmed the trial court's judgment for defendant. Plaintiff had reserved land bordering the pond for use as a public park. Plaintiff's grantees were not riparian owners and consequently were not entitled to bathing privileges. Plaintiff's grant of public and private bathing privileges would have constituted an unreasonable use of the water. Riparian owners are limited to reasonable use of waters with due regard to the rights and necessities of other riparian proprietors. Riparian rights can only be claimed by a riparian owner, and an owner has no property in the water itself but a simple usufruct while such water passes along. The court's application of these general rules indicated that plaintiff's contemplated sales were extraordinary and unreasonable. (Duss-Florida)
W71-02314

CHICAGO MILL AND LUMBER CO V TULLY (TITLE TO ACCRETED LANDS).
130 F2d 268-276 (8th Cir 1942).

Descriptors: *Boundaries (Property), *Arkansas, *Accretion (Legal aspects), *Boundary disputes, Mississippi River, Rivers, Lumbering, Meanders, Islands, Bayous, Navigable waters, Drainage, Watersheds (Basins), Channels, Avulsion, Alteration of flow, Erosion, Maps, Riparian land, Water levels, Diversion.

Plaintiff lumber company brought suit to quiet title to certain lands allegedly accreted to other land owned by plaintiff. Defendant alleged that said lands were an accretion to lands in which defendant had legal title. The trial court appointed a master to determine the facts. The master found for defendant and the Court of Appeals, Eighth Circuit, affirmed. The court found that the land in question had been built up by accretion and not by avulsion. Whether such accreted lands were part of defendant's land or plaintiff's land was a question of fact for the master. The court found that there was no abuse of discretion in the master's finding. (Barnett-Florida)
W71-02315

NORTHERN IND POWER CO V CASTOR (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD LAND).
156 NE 571-574 (Ind 1927).

Descriptors: *Indiana, *Obstruction to flow, *Prescriptive rights, *Flood damage, Floods, Flooding, Backwater, Overflow, Dams, Levees, Rivers, Streamflow, Powerplants, Construction, Damages, Banks, Farms, Land tenure, Watercourses (Legal), Legal aspects, Judicial decisions.

Plaintiff farm owner sought to recover damages from defendant power company for the flooding of his land. Defendant had constructed a dam below plaintiff's land so that water backed up and flooded his property. Plaintiff alleged that construction of the dam was unlawful, was done without plaintiff's consent and was completed without a payment or tender of damages to him. Defendant contended that it had a prescriptive right to maintain the dam by virtue of the fact that there had previously been three dams in the same location, all of which had flooded plaintiff's land. Defendant admitted that flooding by the third dam had been reduced because of damages to it for some years prior to construction of the present dam. The jury returned a verdict for plaintiff, and the Appellate Court of Indiana affirmed. The court held that a prescriptive right to flood land is measured by the extent the right is exercised, in the instant case extending as far onto plaintiff's land as was habitually overflowed. Such a right and its exercise was properly a question for the jury. (Duss-Florida)
W71-02316

COLLINS V GERHARDT (OWNERSHIP OF BEDS OF NAVIGABLE RIVER SUBJECT TO RIGHTS OF NAVIGATION IN PUBLIC).
237 Mich 38, 211 NW 115-128 (1926).

Descriptors: *Michigan, *Navigation, *Ownership of beds, *Public rights, Navigable waters, Boundaries (Property), Riparian land, Riparian waters, Riparian rights, Damages, Judicial decisions, Legal aspects, Relative rights, Fishing, Patents, Grants, Beds under water, Land tenure.

Plaintiff owned land on either side of a river. He claimed that the part of the river which flowed through his land was his own and that he owned exclusive fishing rights therein. Plaintiff brought action in trespass against defendant for violating his alleged fishing rights. Defendant contended that the river was navigable, and therefore all rights of ownership in plaintiff were subject to the public's rights of fishing and navigation. The court applied the floatage test and declared the river to be navigable. An owner having title to land on either side of a navigable river owns the soil thereunder. However, the common law doctrine that the right of fishery follows the ownership of the beds was rejected by the court. Title to the beds is held subject to the rights in the public of navigation and fishery, whether held by the state or a private citizen. The trial court's judgment for plaintiff was reversed. (Price-Florida)
W71-02317

MORGAN V KLOSS (CONSTRUCTION OF BRIDGE TO ISLAND IN NAVIGABLE LAKE FOR PRIVATE PURPOSES).
244 Mich 192, 221 NW 113-114 (1928).

Descriptors: *Michigan, *Islands, *Navigable waters, *Bridge construction, Lakes, Bridges, Administrative agencies, Administrative decisions, State governments, Navigation, Depreciation, Riparian land, Legislation, Judicial decisions, Legal aspects, Regulation.

Plaintiff littoral landowners brought action to enjoin defendant from building a bridge from the lakeshore to an island. Plaintiffs contended that the bridge would be a nuisance, inhibit navigation, and depreciate their property values. Defendants had obtained permission from the board of county supervisors to erect the bridge. The court determined that the bridge would unquestionalbly hamper navigation. Furthermore, the court stated that authority to erect bridges over navigable waters for private purposes must be explicitly granted by the legislature. Finding no such authority to erect bridges over navigable lakes, the court held that the consent given by the county was ultra vires, and affirmed the lower court's decree enjoining construction of the bridge. (Hart-Florida)
W71-02318

FOX RIVER PAPER CO V RAILROAD COMM'N (ACQUISITION OF LICENSE FOR DAM OPERATION).
208 NW 266 (Wis 1926).

Descriptors: *Wisconsin, *Legislation, *Permits, *Dams, Navigable waters, Regulation, Cities, State governments, Railroads, Administrative agencies, Structures, Water works, Compensation, Eminent domain, Administrative decisions, Supervisory control (Power).

Plaintiff brought action to review an order of defendant Railroad Commission denying plaintiff a permit to operate an existing dam which was constructed without legislative authority. Defendant denied the permit on the ground that the provision of the statute requiring the applicant to consent to valuation and condemnation proceedings prescribed therein, in the event that the property be taken over by the state, was not included in plaintiff's application for a permit. Plaintiff alleged that the provision was unconstitutional and that defendant had no right to require such a consent as a condition precedent to its entertaining and considering the application. The Supreme Court of Wisconsin affirmed the lower court's holding that the law was constitutional (Barnett-Florida)
W71-02320

SOUTHERN RY V THACKER (LIABILITY FOR OBSTRUCTING PROPERTY'S NATURAL DRAINAGE).
179 SE 225-228 (Ga 1935).

Descriptors: *Georgia, *Obstruction to flow, *Ditches, *Drainage, Overflow, Watercourses (Legal), Damages, Land tenure, Embankments, Erosion, Flow, Ponds, Construction, Surface waters, Surface runoff, Surface drainage, Railroads, Washouts, Gullies, Legal aspects, Judicial decisions.

Defendant railroad had constructed an embankment which obstructed the natural drainage of plaintiff's property. It constructed a ditch to compensate for this but failed to keep it cleared out so that water backed onto plaintiff's property. Plaintiff sought to recover damages for such flooding. Defendant contended that the cause of action was based on its construction of the embankment and that it owed no duty to plaintiff regarding the embankment. The trial court found for plaintiff, and the Court of Appeals of Georgia affirmed. Defendant owed a duty to plaintiff to keep the ditch clear so that water would be drained off. The court held that it was clear that the action was based on defendant's failure to keep the ditch unobstructed. Plaintiff was only limited in her recovery to damages which occurred within four years of the filing of suit. (Duss-Florida)
W71-02321

HUMPHRIES V BLACK BETSEY CONSOL COAL CO (LIABILITY FOR FLOOD DAMAGES DUE TO DIVERSION OF STREAM).
178 SE 273-276 (W Va 1934).

Descriptors: *West Virginia, *Diversion, *Channels, *Flood damage, Watercourses (Legal), Floods, Beds, Roads, Road construction, Flow, Legal aspects, Judicial decisions, Adjudication procedure, Construction, Damages, Channeling, Channel flow, Flooding.

Plaintiff landowner sought to recover for flood damages from defendants coal company and county court. Plaintiff alleged that the damages resulted because defendants changed a normal creek channel so that it ran nearer to his property. This change was caused by defendants' construction of a road. Defendant coal company contended that it constructed the road under an agreement with the county court that the county would take over the road. It alleged the road did not constitute an imminent danger to plaintiff and that once such road was taken over by the county, its responsibility ended. The jury found against defendant coal company and for defendant county court, and the Supreme Court of Appeals of West Virginia affirmed. The court held that the agreement between the coal company and county court was unlawful and that the coal company could not escape liability for diverting the stream on the ground of an employer-independent contractor relationship. The court further held that defendant coal company could not escape liability because the county court took over the road before the damages occurred since the diversion caused the damages. One judge dissented. (Duss-Florida)
W71-02322

PORT UTIL COMM'N V MARINE OIL CO (LIABILITY FOR RENT WHERE WATER DEPTH NOT MAINTAINED).
175 SE 818-321 (SC 1934).

Descriptors: *South Carolina, *Leases, *Docks, *Water levels, Depth, Damages, Contracts, Legal aspects, Judicial decisions, Administrative agen-

cies, Relative rights, Adjudication procedure, Remedies, Rent.

Plaintiff utilities commission sought to eject defendant oil company from a wharf for nonpayment of rent. Plaintiff's and defendant's rental agreement called for a minimum depth in the wharf's slip at low tide. Defendant contended that this minimum depth was never maintained by plaintiff and that this breach amounted to a total eviction from a portion of the premises. Therefore, defendant contended that its liability for the rent was suspended. The Supreme Court of South Carolina, in affirming the lower court's decision for plaintiff, held that defendant's contention was not the rule in South Carolina. There can be no eviction unless a tenant actually possesses the premises from which he claims eviction. Defendant never possessed the depth of water. Secondly, defendant was in possession of the premises before the contract was signed. The clause concerning the depth was in the nature of a promised improvement, and plaintiff's failure to perform did not entitle defendant to refuse payment or vacate the premises. Defendant's remedy would have been an action for damages. (Duss-Florida)
W71-02323

COLLINS MFG CO V WICKWIRE SPENCER STEEL CO (UPPER RIPARIAN PROPRIETOR MAY NOT POLLUTE WATER TO THE INJURY OF LOWER RIPARIAN PROPRIETOR).
14 F2d 871-874 (D Mass 1926).

Descriptors: *Massachusetts, *Water pollution, *Pollution abatement, *Riparian rights, Damages, Remedies, Artificial use, Legal aspects, Judicial decisions, Industries, Water reuse, Industrial wastes, Relative rights, Recirculated water, Prior appropriation, Running waters, Streams, Industrial water.

Plaintiff corporation sought to restrain defendant corporation from polluting the waters of the river which flowed through the land of both parties. Plaintiff contended that defendant upper riparian proprietor could not use the waters of the river in such a way as to pollute it to the injury of plaintiff lower riparian proprietor. Defendant contended that plaintiff's claims were too general and did not entitle him to equitable relief. The court held that no riparian proprietor has the right to use the waters of a natural stream for such purposes as would materially corrupt it to the substantial injury of a lower proprietor. Although plaintiff's complaint was very broad, the court found that it warranted equitable relief. (Quesada-Florida)
W71-02324

DAVIS V GULF AND I RY OF TEXAS (SHALLOW AND CROOKED STREAM NOT NAVIGABLE WATERWAY).
31 F2d 109-110 (5th Cir 1929).

Descriptors: *Texas, *Navigable waters, *Navigation, *Bridges, Transportation, Running waters, Streams, Surface waters, Federal government, Remedies, Legislation, Judicial decisions, Legal aspects, Shallow water, Marshes, Barriers.

Plaintiff railroad company sought to enjoin the enforcement of a penalty against it by defendant Secretary of War. The penalty arose from a finding by defendant that plaintiff's bridge was obstructing the navigability of what defendant had determined to be a navigable stream. Plaintiff contended that the stream was merely a drain in a salt marsh, shallow and crooked, and therefore not navigable. Defendant contended the stream was navigable in fact and therefore he was authorized by federal law to penalize plaintiff for obstructing the stream's navigability. The United States Circuit Court of Appeals held that the test of navigability is whether a waterway in its natural state is capable of affording a highway for useful commerce. The court found that the stream was not navigable under this test and upheld an injunction. (Quesada-Florida)
W71-02325

OZARK PIPE LINE CORP V DECKER (LIABILITY FOR STREAM CONTAMINATION BY OIL).
32 F2d 66-69 (8th Cir 1929).

Descriptors: *Missouri, *Damages, *Pollutants, *Water pollution sources, Piping systems (Mechanical), Pipes, Pipelines, Hydraulic structures, Remedies, Legal aspects, Judicial decisions, Springs, Subsurface waters, Water sources, Oil, Oily water.

Plaintiff landowner brought an action for damages against defendant oil corporation based on an alleged oil leak from defendant's pipeline which ran through plaintiff's land. Plaintiff contended that the leakage had caused a spring on his property to become polluted. Defendant contended that there was no evidence from which it could be found that the condition of the spring was attributable to any act or neglect on its part. Defendant maintained that the oil in the spring water could have come from oil that had been in the ground for a number of years. The court held that in order to support a judgment for damages evidence must show more than a mere possibility of contamination from oil pipeline leakage. The trial court's judgment for plaintiff was reversed. (Quesada-Florida)
W71-02326

HODGES V TOWN OF BLUFF CITY (ACQUISITION OF WATER RIGHTS).
32 F2d 779-780 (6th Cir 1929).

Descriptors: *Tennessee, *Municipal water, *Water rights, *Water sources, Springs, Running waters, Spring waters, Legal aspects, Remedies, Judicial decisions, Beneficial use, Reasonable use, Relative rights, Consumptive use, Water demand, Water distribution (Applied), Water supply.

Plaintiff landowner sought to enjoin defendant city from taking water from a spring for municipal purposes. Plaintiff claimed the right to the waters from the spring under a quitclaim deed made out to his vendor and the vendor's sons. Plaintiff contended that his vendor was the grantee of the rights to the spring and therefore those rights had passed to him. Defendant contended that plaintiff had been conveyed only the interests of the vendor and not those of the two sons named in the quitclaim deed. Defendant maintained that it was the successor to the two sons' interest and thus it had a right to two-thirds of the spring water. The court held that one taking under a quitclaim deed conveying water rights to himself and two others was entitled to only a one-third interest in the water of the spring. (Quesada-Florida)
W71-02327

WABASH RR V LEWIS (LIABILITY FOR FLOODING CAUSED BY INSUFFICIENT DRAINAGE THROUGH RAILROAD EMBANKMENT).
48 F2d 519-523 (8th Cir 1931).

Descriptors: *Missouri, *Flooding, *Obstruction to flow, *Flood damage, Backwater, Drainage water, Damages, Floodwater, Floods, Overland flow, Rain, Rain water, Runoff, Storm runoff, Excessive precipitation, Drainage, Surface drainage, Surface waters, Flow, Judicial decisions, Railroads, Surface runoff, Drains, Embankments, Legal aspects.

In an action for damages, plaintiff contended that defendant railroad company had constructed a railroad bed embankment and had failed to provide a sufficient opening through such embankment for the drainage of surface waters. As a result, plaintiff contended drainage waters from a rainfall were obstructed in their natural flow and were caused to back up onto plaintiff's property, thereby flooding and damaging such property. Defendant contended that the rainfall was extraordinary and that its failure to provide drainage through its embankment was not a proximate cause of the flooding. The court stated that where rains are unprecedented, one obstructing flow will not be held liable if the unprecedented rainfall is the sole cause of damage. However, the court held that the evidence indicated that the rainfall was not extraordinary. The court thus ruled that defendant was liable for the damages resulting from its failure to provide for adequate drainage of surface waters. (Snow-Florida)
W71-02328

WILLARD V STONE (EASEMENT FOR WATER SUPPLY MEANS REASONABLE USE OF ALL WATER ON SERVIENT PROPERTY).
253 Mass 555, 149 NE 681-684 (1925).

Descriptors: *Massachusetts, *Springs, *Easements, *Water supply, Reservoirs, Contracts, Judicial decisions, Legal aspects, Remedies, Water sources, Reasonable use, Spring waters, Watercourses (Legal), Droughts, Low flow, Piping systems (Mechanical), Hydraulic structures, Supply contractors, Water contracts, Usufructuary right.

Plaintiff sued to enjoin defendant adjoining landowner from interfering with plaintiff's right to take water from springs on defendant's land. Plaintiff's grantor had obtained an easement to take the water from defendant's grantor and had installed on defendant's land pipes to spring A, a dam, a reservoir and hydraulic rams. Later, after an oral agreement, plaintiff's grantor installed pipes to spring B but did not make some other improvements that he and defendant had agreed to. Later, defendant constructed a second reservoir and connected spring B to it, and during a subsequent drought, the water in spring A was diminished. Defendant questioned whether plaintiff had a right to water from spring B because of the failure of his grantor to fulfil the oral agreement. Defendant also contended that plaintiff had abandoned his easement. The Supreme Judicial Court of Massachusetts, in affirming a decree for plaintiff, held that the original contract entitled plaintiff to use of all the water he reasonably needed from all the springs and the right to do what was necessary to obtain such water. Such right was not abandoned unless abandonment was clearly intended by the owner of the right. (Morris-Florida)
W71-02329

NORFOLK AND W RY V MCCOY (LIABILITY OF RAILROAD FOR RIVERFILL CAUSING OVERFLOW).
257 Ky 32, 77 SW2d 392-394 (1934).

Descriptors: *Alteration of flow, *Railroads, *Floods, *Kentucky, Overflow, Diversion, Obstruction to flow, Streamflow, Barriers, Piles (Foundations), Flow, River flow, Beds, Rivers, River beds, Judicial decisions, Damages.

In an action for damages to land, plaintiff contended that defendant railroad company was liable for overflow of a river onto plaintiff's land. Plaintiff maintained that such overflow was the result of a railroad fill in the river bed upstream from plaintiff's land. The fill allegedly diverted the river from its natural course onto plaintiff's property. Defendant contended that the fill was not the cause of the overflow, but that such overflow was the result of seasonal high waters. The court held that plaintiff had failed to introduce sufficient evidence to establish that the overflow was a result of the fill. Accordingly, plaintiff was denied recovery. (Snow-Florida)
W71-02330

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (OWNER OF BANK OWNS TO THREAD OF CHANNEL).
231 App Div 386, 247 NYS 471-755 (1931).

Descriptors: *New York, *Boundaries (Property), *Islands, *Banks, Ownership of beds, Legal aspects, Judicial decisions, Remedies, High water mark, Real property, Watercourses (Legal), Water

level fluctuations, Streamflow, Riparian land, Riparian waters, Boundary disputes, Channels, River beds, Condemnation, Damages, Eminent domain, Hydroelectric plants.

Plaintiff, who claimed to own land on both sides of the Salmon River as well as an island in the middle of such river, sought an injunction to require removal of defendant hydroelectric company's power plant and transmission lines from the shores of the river. Defendant contended that plaintiff's predecessor in title had sold the shores to defendant's predecessor in title, the deed specifying 'the land between the brink of the two banks' of the river which flowed down a steep gorge. The court affirmed a referee's finding for defendant as to ownership of the shores on both sides of the river. The court found the deed intended to give defendant title to the top of the precipice on each side of the gorge rather than the mere high water mark of the river. As to ownership of the island, the court found a previous case was res judicata in plaintiff's favor. Since defendant could condemn the island, the court ordered defendant to pay for encroachment of its transmission lines on the island. The court found the power plant did not encroach in the island because it was on the mainland side of the thread of the stream, and defendant's title extended to such thread. (Morris-Florida)
W71-02331

KELLY V NAGLE (RIPARIAN RIGHT TO THE NATURAL FLOW OF A STREAM).
132 A 587-594 (Md 1926).

Descriptors: *Maryland, *Riparian rights, *Reasonable use, *Natural flow, Alteration of flow, Competing uses, Diversion, Relative rights, Riparian land, Riparian waters, Severance, Streamflow, Flow, Streams, Springs, Judicial decisions, Spring waters, Pipes, Easements, Land tenure, Water rights.

Plaintiff sought to enjoin defendant from plugging up a pipe which carried water from a spring on defendant's land to plaintiff's non-riparian land. Plaintiff contended that defendant's predecessor in title had granted her the right to acquire spring water through such a pipe. Defendant contended that the grant of such a right was invalid. The court held that the grant had been an invalid exercise of defendant's predecessor's riparian rights. The court stated that a riparian owner cannot divert the waters of a spring in excess of that which he may make a reasonable use of upon his own land. Any other diversion by a riparian would violate the rights of lower riparians to the spring's flow. Defendant's predecessors' grant of the water to a non-riparian was thus putting the water to a use not associated with the riparian's land and as such was an unreasonable use of the spring's water. The grant to plaintiff was therefore invalid, and the court held that plaintiff was not entitled to an injunction. (Snow-Florida)
W71-02332

ROTH V STATE (LIABILITY FOR DROWNING CAUSED BY DEEPENING THE WATERS ADJACENT TO A PUBLIC BEACH).
262 App Div 370, 29 NYS2d 442-444 (1941).

Descriptors: *New York, *Drowning, *Beaches, *Dredging, Recreation facilities, Lakes, Recreation, River basin development, Boating, Swimming, Beds, Beds under water, Lake beds, Basins, Judicial decisions, State governments, Depth, Deep water, Excavation.

Plaintiff, decedent's executor, brought a wrongful death action against the state of New York for negligence which allegedly led to the drowning of decedent. Plaintiff contended that defendant created an unreasonable risk to bathers when it deepened the waters adjacent to a public beach. Plaintiff contended further that, as a result of defendant's acts, decedent, while swimming, stepped into the deepened area and drowned. The court held that the beds of the lake was held in trust by defendant for the people of the state. The public thus had a right to use the waters of the lake for recreation and enjoyment. The court held that defendant, in deepening the waters adjacent to the beach and failing to warn the public of the risk, created an unreasonable risk and would be held liable for injuries resulting from such negligence. The trial court's judgment for defendant was reversed. (Snow-Florida)
W71-02333

TENNESSEE VALLEY AUTHORITY V ASHWANDER (TVA'S AUTHORITY TO SELL POWER IN EXCESS OF THAT PUT TO GOVERNMENTAL USE).
78 F2d 578-583 (5th Cir 1935).

Descriptors: *Dams, *Hydroelectric plants, *Tennessee Valley Authority Project, *Hydroelectric power, Electric power, Electric power production, Electricity, Rivers, Navigable rivers, Navigable waters, Federal government, Administrative agencies, Judicial decisions, Transmission (Electrical), Claims (Contracts), Contracts.

In an action to rescind a contract, plaintiff power company contended that a contract made with the Tennessee Valley Authority was invalid as being an ultra vires act by the Authority. Plaintiff contended that selling its power transmission lines to the Authority was invalid in that the lines were going to be used for an illegal proprietary operation--that the Authority was going to sell power, in excess of government requirements, to private parties. Plaintiff contended that such would be outside the government's authority under the commerce clause. Defendant contended that the selling of the excess power was consistent with its authority under the commerce clause to build dams on navigable rivers. The Circuit Court of Appeals, Fifth Circuit, held that defendant, by virtue of lawful ownership of the dam, owned all the water power created by the construction of the dam. Defendant could thus dispose of water power as freely as it could dispose of any other governmental property. The Authority could thus sell the power in excess of governmental requirements. Such was not an ultra vires act. Therefore, the contract for the transmission lines was valid. (Snow-Florida)
W71-02334

UNITED STATES EX REL GREATHOUSE V HURLEY (FEDERAL GOVERNMENT'S DISCRETIONARY POWER TO ISSUE WHARF PERMITS IN THE DISTRICT OF COLUMBIA).
63 F2d 137-147 (DC Cir 1933).

Descriptors: *Docks, *Ownership of beds, *Riparian rights, *District of Columbia, Navigable rivers, Beds, Beds under water, River beds, Riparian land, Navigable waters, Rivers, Rivers and Harbors Act, Virginia, Maryland, Relative rights, United States, Federal government, Judicial decisions, Federal jurisdiction, Permits, Navigation.

Plaintiffs sought a writ of mandamus to compel the Secretary of War to issue a permit for the construction of a wharf in the Potomac River. Plaintiffs contended that, under a 1785 compact between Maryland and Virginia, they had acquired such property rights to the bed of the Potomac River as to entitle them, as a matter of right, to a permit. Defendant contended that the compact was not applicable to property now within the District of Columbia. Instead, defendant contended, navigable waters were subject to the plenary regulatory power of Congress and the issuance of a permit by the Secretary of War was merely a discretionary act. The court held that the ceding of the District of Columbia by Virginia to the federal government terminated any privilege which Virginia had given to the riparian owners to make use of its bed. The control of the river and its bed is subject to the plenary power of Congress. As a result, the Secretary of War can issue permits for wharf construction at his discretion and mandamus will not lie for discretionary acts of this nature. (Snow-Florida)
W71-02335

SMITH V STASO MILLING CO (DOCTRINE O COMPARATIVE HARDSHIP NOT APPLICA BLE WHERE POLLUTER FOREWARNED O POLLUTION DANGER).
18 F2d 736-739 (2nd Cir 1927).

Descriptors: *Vermont, *Water pollution, *Indu trial wastes, *Pollution abatement, Relative right Sludge disposal, Wastes, Streams, Running wate Damages, Remedies, Legal aspects, Judicial dec sions, Water pollution sources, Riparian rights, A judication procedure.

Plaintiff lower riparian landowner sought to enjo defendant slate grinding corporation from pollu ing, with slate dust and sludge, a brook runni through his land. Plaintiff contended that defe dant had been warned by him before building i mill and that defendant had assured him it wou not defile the brook. Contending that defenda ignored the warnings and broke its promise, plai tiff sought to enjoin defendant's operation ad collect for blasting damages. Defendant contende that it had installed dust arresters and had done possible to prevent the pollution. The United Stat Circuit Court of Appeals held that, in light of t explicit warning given by plaintiff and defendan promise, the burden of successfully avoiding poll tion of the brook fell upon defendant. In conside ing the doctrine of balancing comparative har ships, the court found that plaintiff's forewarni and defendant's promise favored the issuance the injunction. (Quesada-Florida)
W71-02336

CENTRAL OF GEORGIA RY V FAULKNE (LIABILITY FOR CHANGE IN EXISTIN DRAINAGE PATTERN).
114 So 686-688 (Ala 1927).

Descriptors: *Alabama, *Surface drainage, *Ra roads, *Prescriptive rights, Alteration of flo Right-of-way, Transportation, Embankmen Highways, Roads, Judicial decisions, Legal aspec Damages, Surface waters, Natural flow, Drainag Surface runoff, Riddance (Legal aspects), Dive sion.

Plaintiff, who owned land fronting on defenda railway's right-of-way, sued for damages after d fendant widened the embankment on the right-o way. Plaintiff claimed the action destroyed a publ road which led to plaintiff's land and diverted su face waters onto plaintiff's property. Defenda contended the roadway was not a public roa because defendant had not received notice of hostile public claim that would lead to prescriptio and argued that a superior proprietor was under duty to maintain drains to prevent natural flo onto servient lands. The Supreme Court Alabama, reversing a decision for plaintiff, he that open, continuous, public use of a highway f 20 years creates a prescriptive right unless the la downer establishes that the use is permissive a not hostile. Such a prescriptive right may be o tained over a railroad's right-of-way. Also, if t embankment altered the existing drainage patter defendant would be liable for diverting surfa waters onto plaintiff's land. (Morris-Florida)
W71-02337

COVINGTON V CASSIDY BAYOU DRAINAG DIST (RIPARIAN OWNERS' RIGHT T THROUGH A DRAINAGE DISTRICT, PR TECT AGAINST FLOOD BY OBSTRUCTIO OF A WATERCOURSE).
122 So 205-216 (Miss 1929).

Descriptors: *Mississippi, *Bayous, *Drainage d tricts, *Dams, Judicial decisions, Legal aspec Remedies, Watercourses (Legal), Contrac Floods, Engineering structures, Rains, Excessi precipitation, Natural flow, Streamflow, Riparia land, Riparian rights, Obstruction to flow, Repu sion (Legal aspects).

Plaintiff landowners sought an order requiring defendant drainage district to remove a dam on a bayou, claiming it caused flooding of their land in times of excessive rains. Plaintiff had obtained a temporary injunction against construction of the dam when it was first proposed, but the injunction was dropped when both parties signed a consent decree calling for location of the dam elsewhere at plaintiff's expense. Defendants contended that plaintiffs refused to comply with the decree and that, since the bayou was not a natural watercourse, it could be dammed. The Supreme Court of Mississippi, in affirming a decision for defendant, held plaintiff had abandoned its opposition to the damsite by failure to comply with the consent decree. The court also indicated that while there was ample evidence to support the lower court's finding that the bayou was only a watercourse during flooding, such a finding was not necessary. The general rule that riparian proprietors are to be protected against obstructions causing damage does not hold true when other proprietors, through a drainage district, erect works to protect themselves against flooding. One judge dissented. (Morris-Florida)
W71-02338

UNITED STATES V OREGON (OWNERSHIP OF BEDS OF NAVIGABLE AND NON-NAVIGABLE WATERS).
295 US 1, 55 S Ct 610-622 (1935).

Descriptors: *Oregon, *Non-navigable waters, *Lakes, *Ownership of beds, Boundaries (Property), Navigable waters, Federal government, State governments, Legislation, Judicial decisions, Legal aspects, Meanders, Political aspects, Lake beds, Recreation, Real property, Relative rights, Land tenure.

Plaintiff United States brought an action to quiet title to certain submerged lands situated under several connected lakes in defendant state. Plaintiff contended that at the time of defendant's admittance into the Union the lakes were non-navigable and therefore title to the beds remained in the United States. Plaintiff asserted that only title to submerged lands under navigable water passed to states upon their admittance to the Union. Defendant contended that the lakes were navigable upon its entrance into statehood and, in the alternative, that plaintiff had conveyed some riparian property to individuals, and thus the beds were owned by the state. The Supreme Court held that while title to lands underlying navigable waters passes to a state upon its admission to the United States, title to lands underlying non-navigable waters remains in the United States and that whether a grant by the United States of uplands bordering on non-navigable waters carries with it the title to the beds depends upon the intention of the grantor. The court noted that the laws of the United States alone control the disposition of the lands of the United States located within states, and states are powerless to place limitations on such control. (Quesada-Florida)
W71-02339

UNITED STATES V ARIZONA (CONGRESSIONAL AUTHORIZATION REQUIRED FOR FEDERAL DAM PROJECTS).
295 US 174, 55 S Ct 666-673 (1935).

Descriptors: *Arizona, *Dams, *Navigable waters, *Federal-state water rights conflicts, Federal government, State governments, Legal aspects, Legislation, Damsites, Beneficial use, Electric power, Water resources development, Projects, Project purposes, Planning, Judicial decisions, Colorado River, United States, Regulation, Dam construction.

Plaintiff United States sought an injunction to prevent defendant state from interfering with a federal dam project on the Colorado River. Plaintiff contended that the dam project was authorized by Congresss under its power over navigable waters. Defendant contended that while Congress had power over navigable waters, it had not authorized the project in question. Defendant further maintained that the Chief of Engineers had not authorized the project as was required by the National Industrial Recovery Act. The Supreme Court held that the project did not have proper congressional authorization. The United States could not enjoin interference by the state of Arizona as to the proposed dam where the construction of the dam was not properly authorized. (Quesada-Florida)
W71-02340

HILT V WEBER (OWNERSHIP OF LAND ALONG LAKE'S EDGE).
252 Mich 198, 233 NW 159-170 (1930).

Descriptors: *Michigan, *Accretion (Legal aspects), *Riparian rights, *Boundaries (Property), Land tenure, Eminent domain, Compensation, Lake Michigan, Navigable waters, Navigation, Beds, Ownership of beds, Boundary disputes, Damages, Public rights, Surveys, Riparian land, Legal aspects, Judicial decisions, Lakes, Great Lakes.
Identifiers: *Meander lines.

Plaintiffs filed a bill to foreclose a land contract on land bordering Lake Michigan. Defendants claimed fraud in that the boundary of ownership was an old meander line, and consequently relicted land belonged to the state. Defendants were awarded damages. The Supreme Court of Michigan reversed, holding that the shoreline and not the meander line was plaintiffs' true boundary. Under federal law, a purchaser from the government of public land on the Great Lakes took title to the water's edge. Meander lines had no force as boundaries to waters other than the Great Lakes. The court ruled that a prior case, holding that riparian owners on the Great Lakes owned only to the meander line and that the status of land as lake bottom was fixed by the meander line, was incorrect. All riparian owners own to the water's edge. Right to acquisitions to land through accession or reliction is a riparian right. Title to the shoreline is a movable freehold. The state cannot take private property without compensation, which would occur if relicted land were held to belong to the state. Generally, riparian rights are: (1) water utilization for general purposes; (2) to wharf out to navigability; (3) access to navigable waters; and (4) right to accretions. Such rights are property, and in taking them, the state must pay compensation. Such rights do not interfere with the state's paramount right to free and unobstructed use of navigable waters for navigation. (Duss-Florida)
W71-02341

SS KRESGE CO V RAILROAD COMM'N (RIGHT TO CONSTRUCT BUILDING ON BED OF STREAM).

235 NW 4-9 (Wis 1931).

Descriptors: *Wisconsin, *Navigable rivers, *Riparian rights, *Buildings, Administrative agencies, Easements, Public rights, Mississippi River, Navigation, Navigable waters, Beds, Legislation, Bridges, Dams, Water levels, Flow, Obstruction to flow, Permits, Riparian land, Judicial decisions, Legal aspects, Channels, Construction.

Plaintiff brought suit against defendant railroad commission to have declared its right to erect a building over the bed of a river. Plaintiff also sought to restrain defendant from objecting to the issuance of a permit for the erection of the building. Plaintiff alleged that the river was not navigable in that it: (1) had insufficient depth, (2) contained many natural obstructions, and (3) contained many man-made obstructions. The Wisconsin supreme court held, first, that the commission could not be enjoined from objecting to the granting of a permit, as this was a matter within its discretion. Secondly, the fact that the river was not presently navigable, did not mean that there would never be navigation of the river. It is well established that the right of a riparian in the bed of a stream is subject to a public easement of navigation, including the right to improve the stream's navigability. Plaintiff's rights were, therefore, subordinate to the right of the state, as trustee for the public, to improve navigation by eliminating obstructions. (Duss-Florida)
W71-02342

VAN CORTLANDT V NEW YORK CENT RR (PRIVATE RIGHT TO RELIEF FROM PUBLIC NUISANCE).
265 NY 249, 192 NE 401-406 (1934).

Descriptors: *New York, *Navigable waters, *Bridges, *Navigation, Navigable rivers, State governments, Railroads, Adjudication procedure, Legal aspects, Judicial decisions, Highways, Remedies, Damages, Legislation, Bridge design, Boats, Ships, Transportation, Bodies of water, Streams, Rivers, Costs.

Plaintiff riparian owner sought a judgment enjoining defendant railroad from maintaining a rigid bridge across a navigable stream. The lower court found the stream to be navigable and the bridge a public nuisance and impediment to navigation but held plaintiff's action to be barred by laches since the bridge had been in existence for forty years. Both parties appealed, plaintiff from the adverse judgment and defendant from the findings of navigability and nuisance. The Court of Appeals of New York affirmed the trial court's judgment. A delay of forty years did not bar plaintiff from enjoining a continuing nuisance, but did have bearing on the extent and materiality of plaintiff's injury. To maintain an action for a public nuisance plaintiff had to show some injury different in kind from that to the public at large. Removal of the instant bridge would have allowed navigation only to a post road crossing the stream 2400 feet upstream. Construction of a drawbridge and improvement of the channel would have cost $3,750,000. The court held that obstruction of navigation by defendant's bridge did not cause sufficient private damage to entitle plaintiff to relief. (Dye-Florida)
W71-02343

FREED V MIAMI BEACH PIER CORP (INFRINGEMENT OF OCEANFRONT RIGHTS).
112 So 841-846 (Fla 1927).

Descriptors: *Florida, *Riparian rights, *Navigable waters, *Boundaries (Property), Land, Real property, High water mark, Low water mark, Legal aspects, Judcial decisions, Docks, Coastal structures, Concrete structures, Piers, Shores, Beaches, Relative rights.

Plaintiff and defendant owned adjoining lots on the ocean front. Defendant obtained permits for and began to construct a pier extending into the water fronting its property. The pier was not constructed at a right angle to the shoreline and extended to some extent into the waters fronting plaintiff's property. Plaintiff sought to enjoin further construction, contending that the pier would obstruct the distant view from his property, which was occupied by a casino. The Supreme Court of Florida affirmed a judgment for defendant. Riparian owners on navigable waters have a right of access and a right to a reasonably unrestricted distant view. Riparian rights in the instant case extended not along extensions of the land lines but on lines at right angles to the high water mark from the corners of the lots. Defendant's pier extended across lines so drawn, but only a minor restriction of plaintiff's view resulted. Plaintiff's right of access was unimpaired. The court held that plaintiff's rights were not infringed to the extent necessary to justify relief at the state of construction defendant had reached. (Dye-Florida)
W71-02344

LAND V BROCKETT (TITLE TO UNMEANDERED PENINSULA).
162 La 519, 110 So 740-743 (1926).

Descriptors: *Louisiana, *Boundary disputes, *Boundaries (Property), *Meanders, Land tenure, Legal aspects, Judicial decisions, Land, Real property, Banks, Lakes, Shores, Lake shores, Navigable waters, Surveys, Estimating, Public lands.

Plaintiff, under a patent, held property bordering a lake. The survey of the patent excluded a 90-acre peninsula extending into the lake. Defendant fenced this peninsula and built a homestead and outbuildings thereon. Plaintiff sought to have himself declared owner of the peninsula, contending that his patent conveyed to the water line and thus included the peninsula. The Supreme Court of Louisiana reversed a judgment for plaintiff. Where a patent purports to convey to the water line, the water line is generally the boundary of the property conveyed, even if the meander line of the survey deviates therefrom. One exception to this rule, however, is in cases where the discrepancy is so great in comparison to the amount of land conveyed that it seems certain that not even an approximate meander of the shoreline was attempted. In the instant case 90 acres was omitted, and it could not be said that a meander was attempted. The land was public and open to entry for homestead purposes by defendant. (Dye-Florida)
W71-02345

KITCHING V BEACHLAND DEV CO (OWNERSHIP OF LAND BETWEEN SURVEY LINE AND NAVIGABLE RIVER).
117 So 789 (Fla 1928).

Descriptors: *Florida, *Surveys, *Boundary disputes, *Boundaries (Property), Judicial decisions, Legal aspects, Navigable rivers, Navigable waters, Measurement, Real property, Land tenure.

Defendant owned land, pursuant to a patent, that was located near a navigable river. Plaintiff possessed the unsurveyed land between defendant's tract and the river. Plaintiff brought an action, alleging that defendant was interfering with plaintiff's right of possession. Plaintiff alleged that he had taken appropriate steps to acquire the land under federal homestead laws. Defendant claimed the land occupied by plaintiff on the theory that the river water line, and not the survey line on his patent, was his boundary. The Florida supreme court held that defendant was not entitled to the land lying between the patent survey line and the navigable river. (Powell-Florida)
W71-02346

STATE V STANDARD OIL CO (VALIDITY OF OIL LEASE TO DRY LAKE BED).
164 La 334, 113 So 867-879 (1927).

Descriptors: *Louisiana, *Lake beds, *Leases, *Ownership of beds, Boundary disputes, Lakes, Navigable waters, Land tenure, Oil wells, Oil fields, Oil industry, Boundaries (Property), Drainage districts, State governments, Administrative agencies, Legal aspects, Adjudication procedure, Judicial decisions, Remedies, Shores, United States, Sea level, Surveys, Mapping.
Identifiers: Levee districts.

Plaintiff state sued defendant oil company to recover the value of oil produced by defendant's wells on a dry lake bed allegedly owned by plaintiff. Defendant had leased the land from a levee district which had been granted the land by the state. Plaintiff contended that the wells were not included in the lease but were on land excluded by a surveyor from the plat incorporated into the lease and since repossessed by the state. Plaintiff also argued that, since the lake was navigable upon the state's admission to the Union, the dry bed was sovereign property and not subject to ownership by the levee district. On rehearing, the court held that the surveyor's error in excluding the land in question did not prevent the parties to the lease, defendant and the levee district, from affirming their intention to include the property in the lease. The court also noted that the decree revesting the land in the state did not act retroactively so as to give the state a cause of action which had already accrued to the levee district. The court vacated its prior judgment and affirmed the judgment for defendant. (Liptak-Florida)
W71-02347

ARCHER V BOARD OF MISSISSIPPI LEVEE COMM'RS (RIPARIAN RIGHTS INCLUDE TAKING GRAVEL FROM RIVER).

130 So 55-56 (Miss 1930).

Descriptors: *Mississippi, *Eminent domain, *Riparian rights, *Boundaries (Property), Condemnation, Riparian land, Riparian waters, Judicial decisions, Legal aspects, Levees, Gravels, Sands, Ownership of beds, Beds, Navigable rivers, Navigable waters, Mississippi River, Flood control, Federal government, Governments, State governments, Water rights.

Defendant owned land abutting the Mississippi River. The chief value of defendant's property was the riparian rights to land in the river for procuring sand and gravel. Plaintiff board of levee commissioners instituted a proceeding to condemn defendant's property. The trial judge instructed the jury not to take into consideration any value of the gravel in the river in determining the value of defendant's condemned property. Defendant appealed the damages award of the trial court for insufficiency. The Supreme Court of Mississippi held that the instruction not to consider the value of gravel in the river channel was reversible error. The court stated that defendant's riparian rights included the right to use land to the center of the stream and to take sand and gravel for commercial purposes, and the taking of such right should have been considered in plaintiff's damages award. (Powell-Florida)
W71-02348

CALDWELL V GORE (DUTY OF LOWER ESTATE TO ACCEPT NATURAL DRAINAGE FROM UPPER ESTATE).
144 So 151-153 (Ct App La 1932).

Descriptors: *Louisiana, *Surface drainage, *Obstruction to flow, *Dams, Ditches, Watercourses (Legal), Arkansas, Surface waters, Surface runoff, Overflow, Remedies, Land tenure, Judicial decisions, Legal aspects, Drainage, Drains, Canals, Overlying proprietor, Relative rights, Adjudication procedure.

Plaintiff upper landowner sought to restrain defendant lower landowner from constructing a dam so as to interfere with the natural drainage of plaintiff's property. Defendant admitted the allegations but contended that: (1) plaintiff's property was located in Arkansas while defendant's was located in Louisiana; (2) defendant's estate owed plaintiff's no servitude of drainage of surface water; and (3) plaintiff constructed a ditch through his property and increased the burden of drainage upon defendant's estate. The trial court granted the injunction and the Court of Appeal of Louisiana affirmed. The court pointed out that prior cases had ruled that an estate located in Louisiana owes a servitude to drain an upper estate in Arkansas. The court stated that if plaintiff had made defendant's servitude more burdensome, defendant should have resorted to the courts and invoked the summary remedy by injunction. Defendant's construction of the dam constituted taking the law into his own hands, which action could not be condoned by the courts. (Duss-Florida)
W71-02349

LIPSCOMB V GALOURAKIS (STATE AND COUNTY JURISDICTION TO REGULATE THE TAKING OF SPONGES IN GULF WATERS).
133 So 104-107 (Fla 1931).

Descriptors: *Florida, *Local governments, *State jurisdicition, *Commercial fishing, State governments, Fishing, Fishing gear, Equipment, Legal aspects, Judicial decisions, Legislation, High water mark, Boundaries (Property), Beds, Beds under water, Oceans, Gulfs, Bays, Gulf of Mexico, Aquatic animals.

Defendant sponge fishermen sought habeas corpus from an indictment charging them with violating Florida statutes regulating sponge fishing. Defendants contended that the offenses alleged, since they took place in the Gulf of Mexico, were committed outside the jurisdiction of the county where the indictment was brought. The Supreme Court of Florida reversed a discharge of defendants. All the bottoms of gulfs and natural bays within the limits of the state passed to the state when Florida was admitted to the Union. Counties bordering on the Gulf of Mexico have jurisdiction over that area within the Gulf adjacent to the upland and out to the state boundary line. The jurisdiction is bounded by lines drawn at right angles to the high water mark at each county's upland boundary. States may prescribe means and methods by which products of gulf waters within state boundaries may be taken for private or commercial use. (Dye-Florida)
W71-02350

ATLANTIC COAST LINE RR V HENDRY (LIABILITY OF RAILROAD FOR FAILURE TO PROVIDE DRAINAGE UNDER TRACKS).
150 So 598-599 (Fla 1933).

Descriptors: *Florida, *Obstruction to flow, *Excessive precipitation, *Culverts, Surface drainage, Rainfall, Legal aspects, Judicial decisions, Damages, Railroads, Farms, Crops, Construction, Flood damage, Drainage, Surface waters, Natural flow, Rainfall intensity, Floods.
Identifiers: *Act of God.

Plaintiff farmer sued defendant railroad company for flood damages allegedly caused by defendant's failure to construct enough culverts when bulding a railroad bed. The bed bisected plaintiff's land. Defendant argued that the damage to plaintiff's crops was caused by heavy rains which were an act of God. The Supreme Court of Florida, in affirming a verdict for plaintiff, held that a defendant seeking to assert the defense of an act of God has the burden of showing that he did not also contribute to the damage. There was evidence that defendant knew it was not making sufficient provision for passage of water. Defendant had not proved that all damage was caused by an act of God. (Morris-Florida)
W71-02351

THE KARD (DAMAGES TO BARGE CAUSED BY RAILROAD'S DRAWBRIDGE OVER NAVIGABLE WATERS).

38 F2d 844-848 (ED Pa 1930).

Descriptors: *Pennsylvania, *Bridges, *Railroads, *Navigation, Ships, Admiralty, Damages, Legal aspects, Judicial decisions.

Plaintiff barge owner brought libel against defendant tug and her owners, who impleaded defendant railroad. The tug was towing plaintiff's barge upriver and signaled the railroad to open the drawbridge for their passage. The railroad's agent opened the span only partially, and the barge's derrick collided with the drawbridge, causing severe injury. Through a later misunderstanding between plaintiff and defendant tug, the barge was left unattended and sank overnight. The court noted that the right of navigation is paramount to the railroad's right to maintain the bridge, and that the bridge must be operated so that navigation is not

unnecessarily impeded. Stating that the tug might proceed after having given the opening signal, and that raising the draw was an invitation for the tug to pass through, the court held that the railroad had failed to comply with regulations and was therefore liable for the earlier injury. The additional damages caused by leaving the barge unattended overnight should be apportioned between plaintiff and defendant tug. (Hart-Florida)
W71-02352

PAN-AMERICAN PETROLEUM AND TRANSP CO V GREAT LAKES DREDGE AND DOCK CO (DAMAGES FOR STRIKING OBSTRUCTION IN DREDGED CHANNEL).
27 F2d 442-443 (SD NY 1928).

Descriptors: *New York, *Navigable waters, *Admiralty, *Dredging, Damages, Channels, Navigation, Navigable rivers, Federal jurisdiction, Boats, Judicial decisions, Legal aspects, Rocks, Remedies, Adjudication procedure.

Plaintiff ship company brought libel action against defendant dredging company for damages which one of its ships had sustained in a collision with a submerged object. Libelant alleged that the dredging company, which was deepening the channel, had placed rocks in the channel and that libelant's vessel had struck the rock. The federal district court dismissed libelant's action. Libelant had the burden of proving that its damage was occasioned by striking the rock placed in the channel by the dredging company. Libelant had failed to establish this. Furthermore, the evidence showed that libelant was aware of the dredging and had been warned against piloting vessels too near the dredging operations. (Duss-Florida)
W71-02353

UNITED PAPERBOARD CO V IROQUOIS PULP AND PAPER CO (INTERPRETATION OF DEED WITH RESERVED WATER RIGHTS).
215 NYS 741-748 (1926).

Descriptors: *New York, *Water rights, *Dams, *Land tenure, Riparian rights, Ponds, Relative rights, Judicial decisions, Legal aspects, Preferences (Water rights), Riparian waters, Riparian land, Water utilization, Reasonable use, Adjudication procedure.
Identifiers: *Flashboards.

The lands of plaintiff and defendant, located on a river, originally formed a single tract. The parties' predecessor in title had obtained water from a pond above a dam located above the single tract. In obtaining the water the grantor had placed flashboards on top of the dam. Subsequently, the deed, which conveyed half of the single tract to plaintiff, granted plaintiff all water rights to the pond except rights to the water actually flowing over the crest of the dam. Defendant acquired the remainder of the tract, including the water rights reserved from plaintiff's deed. Plaintiff sought an injunction to enjoin defendant from withdrawing water from the pond. Defendant contended that the deed reservation permitted him to draw pond water whenever its level was higher than the crest of the dam, exclusive of flashboards. Plaintiff contended the water had to be actually flowing over the flashboards. The appellate court, in granting an injunction, held the grant permitted defendant to use only water flowing over the flashboards. The court stated that the water right, as primarily granted, would not be impaired by the exception in the grant further than necessary. (Powell-Florida)
W71-02354

PEOPLE V NEW YORK AND ONTARIO POWER CO (OWNERSHIP OF BEDS OF NAVIGABLE STREAMS).

219 App Div 114, 219 NYS 497-504 (1927).

Descriptors: *New York, *Ownership of beds, *Navigable waters, *Navigable rivers, Navigation, Channels, Beds, Dams, Boats, Islands, Shores, Riparian land, Riparian rights, Land tenure, Public rights, State jurisdiction, Water rights, Permits, Powerplants, Rivers, Streams, Judicial decisions, Legal aspects, Hydroelectric power, St. Lawrence River.

The people of New York brought action in ejectment to recover land in the bed of the St. Lawrence River. The land was claimed by defendant power company and defendant corporation. Defendant power company owned and operated a dam on the River. The trial court dismissed the complaint and the appellate court affirmed. The court stated that the St. Lawrence River was a navigable stream. Rights and title in the beds of navigable streams are controlled by the state law where the stream is located. Title to beds is in the state in trust for the people unless specifically granted to others. The state holds the right to control commerce and navigation, but it may grant, in the public interest, unconditional rights in shore waters or streams. All grants for private benefit are conditional ones and subject to the right of the state to improve the stream. One may not acquire rights which deprive the state of the power to improve navigation. Riparian owners on navigable streams possess the same rights as owners on private streams. Defendant power company was a riparian ownerbut not the owner of the bed where its dam was located. However, none of defendant's construction on the bed obstructed navigation. The court held, therefore, that the state would not be prejudiced by permitting defendant to continue its use until the state adopted a plan for developing the stream. (Duss-Florida)
W71-02355

VAN CORTLANDT V NEW YORK CENT RR (BRIDGE OBSTRUCTING NAVIGABLE STREAM NOT ENJOINED WHERE NO DAMAGE SHOWN).
238 App Div 132, 263 NYS 842-853 (1933).

Descriptors: *New York, *Bridges, *Navigable waters, *Navigation, Streams, Riparian rights, Relative rights, Public rights, Legal aspects, Remedies, Damages, Judicial decisions, Structures, Railroads.

Plaintiff upper riparian landowners sought an injunction to force defendant railroad company to remove a bridge extending across a stream. Plaintiffs contended that, although an accumulation of silt and debris rendered the stream navigable only to small craft, it was still navigable in fact. Plaintiffs therefore maintained that defendant could not erect an obstruction to navigation thereupon. Defendant contended that plaintiffs' had suffered no damage and that their rights had not been impaired. In addition, defendant contended that the stream was not navigable because only small craft could navigate the waters. The New York Supreme Court held that: (1) a stream which at one time has been navigable but because of accumulation of debris and silt is navigable only to small craft is navigable in fact; but (2) where damages are speculative, although the stream might in the future be made profitably navigable, riparian owners are entitled only to nominal damages. (Quesada-Florida)
W71-02356

PIGEON RIVER IMPROVEMENT, SLIDE AND BOOM CO V CHARLES W COX, LTD (USE AND CONTROL OF STREAMS WHICH FORM AN INTERNATIONAL BOUNDARY).
291 US 138, 54 S Ct 361-368 (1934).

Descriptors: *Minnesota, *Navigable waters, *Competing uses, *International waters, Rivers, Legislation, Federal government, State governments, Legal aspects, Judicial decisions, Political aspects, Industrial use, Structures, Dams, Lumbering, Access routes, Riparian rights, International law, Boundaries (Property), Treaties, Relative rights, Regulation.

Plaintiff Minnesota corporation brought an action against defendant Canadian corporation to collect tolls for the use by defendant of improvements maintained by plaintiff in the Pigeon River, a boundary stream between Minnesota and Canada. Plaintiff contended that it was authorized by Congress and the state of Minnesota to maintain such devices and to collect tolls for their use as an aid to commerce. Defendant contended that according to a treaty between the United States and Canada it had the right to the use of the river both in Canada and the United States. The Supreme Court held that congressional acquiescence in the action of the state of Minnesota in authorizing improvements on that part of the river within its jurisdiction constituted a practical construction of the treaty and that the state could authorize the creation of improvements in a navigable river to aid commerce if such improvements were not a violation of the treaty or in conflict with congressional legislation. The trial court's judgment for defendant was reversed. (Quesada-Florida)
W71-02357

WYOMING V COLORADO (ENFORCEMENT OF JUDICIAL DECISION SETTING OUT RELATIVE RIGHTS OF ADJOINING STATES TO QUANTITY OF WATER DIVERTED FROM NAVIGABLE RIVER).
286 US 494, 52 S Ct 621-627 (1932).

Descriptors: *Wyoming, *Colorado, *Diversion, *Relative rights, Diversion dams, Navigable waters, Alteration of flow, State governments, Riparian rights, Irrigation practices, Legal aspects, Judicial decisions, Beneficial use, Public benefits, Adjudication procedure.

Plaintiff state sought to enforce against defendant state an earlier court decree as to the relative rights to divert water from a navigable river which flowed through defendant state into plaintiff state. Plaintiff contended that defendant state was violating the provisions of the decree by diverting water in excess of its allotted amount. Plaintiff maintained that it should be permited to install measuring devices in the river within defendant state in order to insure compliance with the provisions of the decree. Defendant denied that it was diverting water in excess of its quota and refused to allow plaintiff to install the measuring devices. Additionally, defendant contended that if any additional water was being diverted, it was being done by private corporations acting without state authority, for which defendant state was not liable. Defendant further contended that the suit should be dismissed because it contained no specific allegations. The Supreme Court of the United States held that the allegations of plaintiff were sufficient to warrant a determination by the lower court and should not be dismissed. Defendant was required to answer plaintiff's bill. (Quesada-Florida)
W71-02358

UNITED STATES V HOLT STATE BANK (TITLE TO LAND UNDER NAVIGABLE WATER VESTS IN STATE ON ADMISSION TO UNION).
270 US 49, 46 S Ct 197-200 (1926).

Descriptors: *United States, *Lakes, *Navigable waters, *Ownership of beds, Minnesota, Lake beds, Land reclamation, Public lands, Federal reservations, Indian reservations, Boundaries (Property), Land tenure, Federal government, State governments, Navigation, Rivers, Legal aspects, Public rights, Legislation, Judicial decisions, Adjudication procedure.

Plaintiff United States brought suit against defendant bank to quiet title to land that once was a lake bed. Plaintiff argued that the lake was not navigable when Minnesota, defendant's grantor, was admitted to the Union and that the lake was part of an Indian reservation, to be disposed of as homestead property. Defendant argued that the lake was navigable in fact and title to the bed was therefore vested in the sovereignty of the state upon its admission to the Union. Affirming the dismissal of the

complaint, the Supreme Court held that the lake was navigable in fact, even though the lower courts erroneously applied local standards, since the same result would have been reached by applying the federal standard of 'susceptibility to navigation.' The court noted that the United States held submerged lands in trust for future states, and a disposal of such land could not be lightly inferred in the absence of legitimate public purpose or international obligation. (Liptak-Florida)
W71-02359

ARKANSAS POWER AND LIGHT CO V ORR (LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT FLOODGATE OPERATION).
298 SW 1029-1032 (Ark 1927).

Descriptors: *Arkansas, *Water injury, *Hydroelectric plants, *Floodgates, Streams, Overflow, Flood damage, Floods, Crop response, Dams, Reservoir operation, Lakes, Legal aspects, Natural flow doctrine, Rainfall, Cloudbursts, Riparian land, Riparian rights, Damages, Judicial decisions, Adjudication procedure.

Plaintiff landowner brought action against defendant power company to recover for flood damage to his corn crop caused by defendant's operation of floodgates at its hydroelectric plant. Plaintiff contended that defendant's employees were negligent in opening the floodgates so as to increase the water flow and cause an overflow of plaintiff's land. Defendant contended that the overflow was the result of heavy rainfall rather than negligence, that such overflow occurred both above and below the dam, and that defendant was not an insurer of the safety of riparian lands. The court noted that submission of the allegation and proof of negligence to the jury was proper and did not operate to make defendant an insurer. However, the court reversed the judgment for plaintiff and remanded the case for a new trial because of the improper admission of hearsay evidence concerning the conduct of defendant's employees in operating the floodgates. (Liptak-Florida)
W71-02360

RYAN V COMM'RS OF WATER DIST NO 1 (NOTICE REQUIRED FOR VALID ASSESSMENT BY WATER DISTRICT).
220 Ky 822, 295 SW 1023-1025 (1927).

Descriptors: *Kentucky, *Assessments, *Water districts, *Adjudication procedure, Remedies, Taxes, Government finance, Water supply, Governments, Local governments, Legislation, Administrative agencies, Administrative decisions, Legal aspects, Judicial decisions, Eminent domain.

Plaintiff landowner sued to declare invalid an assessment and proposed bond issue by defendant water district. Plaintiff contended that the assessment was void for lack of due process because the landowners did not receive notice of the proceedings other than by publication. Defendant argued that the statute creating the water district and authorizing the assessment only required notice by publication and that such notice was sufficient for assessments for public purposes. Affirming a judgment for defendant, the court held that personal notice was only required in actions between citizens, and notice by publication was sufficient for eminent domain or tax proceedings between a citizen and a governmental body. The court also noted that the landowners had waived their right to question the validity of the assessment since none of them appeared at, or objected to, the assessment proceedings or the final court hearing. Moreover, they had not prosecuted an appear from any of those proceedings. (Liptak-Florida)
W71-02361

PRUYN V NELSON BROS (BATTURE LAND SUBJECT TO PUBLIC SERVITUDE FOR USE IN CONSTRUCTING AND REPAIRING LEVEES).
180 La 760, 157 So 585-588 (1934).

Descriptors: *Louisiana, *Levees, *Public rights, *Repairing, Banks, Mississippi River, Navigable rivers, Rivers, Accretion (Legal aspects), Administrative agencies, Administrative decisions, Federal government, United States, State governments, Flood protection, Legal aspects, Judicial decisions, Reasonable use, Riparian land, Riparian rights, Excavation, Eminent domain, Easements, Construction, Supervisory control (Power).
Identifiers: *Servitudes.

Plaintiff riparian owner sued to enjoin defendant contractor from removing soil from batture land on the Mississippi River. The soil was to be used by the local levee district and the federal government to make levee repairs. Plaintiff sought to recover damages for soil already removed. Plaintiff contended that the removal of the soil was unnecessary and that part of the soil removed would be used outside of the levee district's territory by the federal government. Defendant contended that all batture land is subject to a public servitude for the building and repairing of levees, limited only by reasonable use, and that the intended use was necessary and reasonable. Since the levee had already been repaired, the court only considered plaintiff's damage claim. The court noted that the United States government was a proper party to exercise the public servitude, especially where its plans had been approved by the proper state and local agencies. Affirming a judgment for defendant, the court held that the evidence showed that the levee repairs were necessary to protect the public from flooding and that it was not unreasonable for the levee district to authorize defendant to use the most available and suitable soil. (Liptak-Florida)
W71-02362

HICKS V STATE EX REL LANDIS (RIGHT TO MAINTAIN DOCK ON STATE-OWNED LAKE BED SUBJECT TO PUBLIC TRUST).

156 So 603-605 (Fla 1934).

Descriptors: *Florida, *Lake beds, *Public lands, *Docks, State governments, Administrative agencies, Administrative decisions, Lakes, Beds, Navigable waters, Ownership of beds, Public rights, Legal aspects, Judicial decisions, Navigation, Access routes, Permits, Recreation.

Plaintiff state brought action to evict defendant from a portion of the bed of a navigable lake and to compel defendant to remove a wharf and two boathouses which he had erected. Plaintiff contended that land under navigable waters is held by the state in trust for the people, for their navigation and enjoyment, and that defendant was trespassing on such trust property. Defendant contended that the state board of trustees, which held title to all state sovereignty lands, had granted to the county the right to use the land for improvement of public access to the lake. The county had transferred that right to defendant. Reversing a judgment for plaintiff, the court held that the board of trustees could lawfully convey rights in sovereignty lands as long as the conveyance was in promotion of the public interest. (Liptak-Florida)
W71-02363

INLAND WATERWAYS CO V CITY OF LOUISVILLE (CITY'S POWER TO LEASE WATERFRONT FOR PRIVATE WHARF PURPOSES).
227 Ky 376, 13 SW2d 283-288 (1929).

Descriptors: *Kentucky, *Navigable rivers, *Docks, *Leases, Rivers, Ohio River, Inland waterways, Permits, Cities, Local governments, Legislation, Riparian land, Riparian rights, Riparian waters, Public rights, Transportation, Legal aspects, Judicial decisions.

Plaintiff city leased river front property to defendant corporation to develop a river terminal. Plaintiff then brought action to declare the lease invalid and to recover the property. Plaintiff contended that the grant of a franchise to operate a public wharf requires an advertisement and public sale and that the board of public works, which granted the lease, had no power to grant such a franchise. Defendant contended that the city could lease its property for wharf purposes just as any other riparian owner. Reversing a judgment for plaintiff, the court noted that a franchise was a grant of a right which could not be exercised without sovereign authority. However, the right to wharf and lease property was common to all riparian owners. The court also noted that whether the wharf was public or private did not depend on the ownership of the land on which the wharf was built, but the use to which the wharf was put. (Liptak-Florida)
W71-02364

ARKANSAS POWER AND LIGHT CO V BEAUCHAMP (NEGLIGENCE IN DAM OPERATION AS CAUSE OF FLOODING).
43 SW2d 234-237 (Ark 1931).

Descriptors: *Arkansas, *Adjudication procedure, *Dams, *Floods, Damages, Legal aspects, Streams, Judicial decisions, Precipitation excess, Electric power industry, Floodgates, Structures, Flood damage, Flow, Low water mark, Reservoir operation, Floodwater, Overflow, Rain, Rainwater.

Defendant power company operated a dam upstream from plaintiffs' property. During a period of heavy rainfall plaintiffs' lands were flooded and their crops destroyed. Palintiffs sought damages, contending that the damage resulted from negligent operation of defendant's dam. Defendant contended that the damage was caused by normal floodwaters and introduced evidence indicating a lack of negligence. Despite defendant's evidence, a jury found for plaintiffs. Defendant appealed on the grounds that plaintiffs had not proved their case. The Supreme Court of Arkansas affirmed. A verdict supported by some substantial testimony may not be set aside on appeal, even though apparently against a preponderance of the evidence. In the instant case the floodwaters were clear, indicating that they came from the reservoir. Moreover, the waters rose faster than in times before the construction of the dam. Such evidence was sufficient to support a jury's inference of negligence. (Dye-Florida)
W71-02365

MISSOURI PAC RR V BAKER (LIABILITY FOR FLOOD DAMAGE CAUSED BY CLOGGED CULVERT).
64 SW2d 321-322 (Ark 1933).

Descriptors: *Arkansas, *Floods, *Culverts, *Damages, Railroads, Crops, Crop production, Flood damage, Surface drainage, Legal aspects, Adjudication procedure, Judicial decisions, Water injury, Surface runoff, Obstruction to flow.

Plaintiff landowner sued defendant railroad for damages caused by crop flooding. Defendant's railroad culvert became clogged, causing water to back up and flood plaintiff's crops. On appeal, defendant contended that there was insufficient evidence to justify the jury verdict that the clogged culvert caused the damage and that the trial court erred in failing to instruct the jury that it was plaintiff's duty to minimize damages by clearing the culvert himself. The Supreme Court of Arkansas found ample evidence to justify the verdict. Noting that to minimize damages plaintiff would have had to trespass, the court held that under the circumstances plaintiff was not required to clear the culvert. The lower court's decision for plaintiff was affirmed. (Hart-Florida)
W71-02366

BOURLAND V CITY OF FORT SMITH (PROPRIETY OF CITY'S ACTION TO IMPROVE WATER SUPPLY).
78 SW2d 383-386 (Ark 1935).

Descriptors: *Arkansas, *Cities, *Contracts, *Reservoirs, Water works, Financing, Government finance, Interest, Administrative agencies, Water supply, Water rates, Dams, Domestic water, Water sources, Judicial decisions, Legal aspects, Supervisory control (Power), Water pollution.

Plaintiff municipal landowner sought to enjoin defendant city from building a reservoir and conveying such improvmenets to a waterworks district. Plaintiff alleged that the project was an abuse of discretion and that the contracts between the city, waterworks district, and the Public Works Administration were ultra vires. The court determined that the project was necessary because of pollution of the existing water supply, rejecting plaintiff's abuse-of-discretion argument. The court observed that a literal interpretation of the statute creating the waterworks district would justify plaintiff's latter assertion, but stated that the statute's purpose was to furnish the municipality with an adequate water supply. The statute should be liberally interpreted and applied to achieve that purpose. Holding that the project was valid, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-02367

CASHION V MEREDITH (OWNERSHIP OF ACCRETED LAND).
64 SW2d 670-674 (Mo 1933).

Descriptors: *Missouri, *Accretion (Legal aspects), *Land tenure, *Real property, Legal aspects, Judicial decisions, Adjudication procedure.

In a suit for ejectment and partition, involving adverse possession, the Supreme Court of Missouri stated that accreted land becomes the property of the owner of the tract to which it attached. (Hart-Florida)
W71-02368

ZOOK V CITY OF LOUISIANA (BLOCKAGE OF DRAIN CAUSED BY CITY'S PAVING OF STREET).
12 SW2d 518-520 (Mo 1929).

Descriptors: *Missouri, *Surface runoff, *Paving, *Diversion, Road construction, Surface waters, Cities, Drains, Alteration of flow, Flood damage, Legal aspects, Damages, Legislation, Channels, Adjudication procedure, Local governments, Ditches, Erosion, Judicial decisions, Overflow, Natural flow, Obstruction to flow.

In an action for damages, plaintiff alleged that when defendant city paved a street near her property, it negligently filled in the gutter which carried surface water therefrom. This caused surface runoff to be diverted onto plaintiff's property. In reversing a lower court decision for the city, the appellate court held that plaintiff had stated a cause of action. Municipalities are liable where, in the construction of streets, surface runoff is forced out of its natural drainage and onto adjacent landowners' property. While the city was entitled to cast off surface waters as a consequence of paving and grading a street, it was not entitled to change the natural flow of surface water and cast it onto plaintiff's property in an increased volume. (Caldwell-Florida)
W71-02369

KENTUCKY ELEC DEV CO'S RECEIVER V WELLS (LIABILITY FOR DAMAGE CAUSED BY DAM MAINTAINED AT UNAUTHORIZED HEIGHT DURING UNPRECEDENTED FLOOD).
256 Ky 203, 75 SW2d 1088-1095 (1934).

Descriptors: *Kentucky, *Dams, *Historic flood, *Public utilities, Water injury, Floods, Backwater, Maximum probable flood, Streams, Hydroelectric plants, Concrete dams, Damages, Legal aspects, Judicial decisions, Prescriptive rights, Eminent domain, Obstruction to flow.

Plaintiff landowner brought action against defendant electric company to recover for flood damages to his land, and also sought to restrain defendant from maintaining the dam at a height higher than that maintained by defendant's predecessor. Plaintiff contended that the new height of the dam interfered with the drainage of his land and that the backwater flooded his crops. Defendant contended that the damage was caused by an unprecedented flood and that the dam could be maintained at any height since defendant was a public service corporation which had the power to obtain the right to dam to the new height by eminent domain. The court noted that, it the extra height of the dam contributed to plaintiff's damage, defendant could still be liable for the results of an unprecedented flood. The court agreed that defendant should not have to remove a permanent portion of the dam, but held that plaintiff should have another cause of action to recover for the permanent damages caused thereby. The court affirmed the damage award and that part of the lower order requiring defendant to remove temporary portions of the dam. However, the court reversed the part of the order requiring defendant to lower the permanent dam structure. (Liptak-Florida)
W71-02370

TOLER V BEAR CREEK DRAINAGE DIST (AUTHORITY OF DRAINAGE DISTRICT TO DIVERT WATER FROM WATERSHED).
106 So 88-94 (Miss 1925).

Descriptors: *Mississippi, *Drainage districts, *Flood control, *Watersheds (Divides), Alteration of flow, Rivers, Drainage practices, Levees, Administrative agencies, Floods, Surface waters, Governments, Legal aspects, Water levels, Diversion, Ditches, Artificial watercourses, Public rights, Benefits, State jurisdiction, Supervisory control (Power), Relative rights, Judicial decisions, Legislation.

Plaintiffs challenged the authority of defendant drainage district to implement a flood control program. The objectionable part of the plan was the digging of three ditches to carry floodwaters out of the district over a divide and into the Sunflower River. Plaintiffs argued that drainage districts were prohibited by statute from diverting water from one watershed to another, and that this would be violated by digging the ditches across a divide. Rejecting the contention, the court held that since the floodwaters would eventually reach the river anyway, regardless of the ditches, the effect of the plan was not to unlawfully transfer water between watersheds. Moreover, the court held that the district was properly established under the police power of the state, the purpose of such districts being to promote the public welfare. The private drainage rights of plaintiffs, landowners within the district, were supplanted by the rights conferred on the district by statute. (Caldwell-Florida)
W71-02371

WYNN V WILSON (SEEPAGE FROM IMPROPERLY CAPPED OIL WELL ALLEGED TO HAVE DAMAGED SPRING AND LAND).
252 Ky 352, 67 SW2d 483 (1934).

Descriptors: *Kentucky, *Oil wells, *Seepage, *Springs, Water supply, Damages, Oil, Well casings, Mixing, Water pollution sources, Adjudication procedure, Legal aspects, Land use, Judicial decisions.

In an action for damages, plaintiff claimed that defendant had improperly plugged an oil well after removal of the casing, thereby causing oil to seep into a spring on plaintiff's property. The court found that although oil was found in the spring some time after the well was improperly plugged, there was no evidence of any seepage from the well into the spring, which was several hundred feet away. Moreover, there was evidence that one of the springs on plaintiff's land had oil in it before defendant's well was drilled, and that no oil had been found in the spring in question until it was cleaned out. Holding that it was probable that the oil had come from a source other than defendant's well, the court reversed a lower court decision for plaintiff. (Caldwell-Florida)
W71-02372

DAWSON V JOHNSON (DISPUTE OVER OWNERSHIP OF STREAM BED).
249 Ky 839, 61 SW2d 878-879 (1933).

Descriptors: *Kentucky, *Boundary disputes, *Boundaries (Property), *Ownership of beds, Meanders, Streams, Land tenure, Legal aspects, Channels, Streambeds, Remedies, Thalweg, Judicial decisions.

Plaintiff sought to assert ownership in the entire bed of a stream forming part of the boundary between his and defendant's property. Defendant claimed that his property extended to the middle of the stream's channel. The court conceded that if each party's deed had conveyed land described as running with the meanders of the stream, each would have acquired title to the middle of the stream. However, the court found that plaintiff's deed, which was prior in time, had conveyed to him ownership of the entire streambed. Therefore plaintiff was entitled to a settlement of the boundary line in his favor. (Caldwell-Florida)
W71-02373

FAIRCHILD V MAYO (DISPUTE AS TO WHETHER A SHIFT IN A STREAM'S CHANNEL RESULTED IN ACCRETION).
232 Ky 778, 24 SW2d 599-600 (1930).

Descriptors: *Kentucky, *Boundary disputes, *Boundaries (Property), *Accretion (Legal aspects), Land tenure, Legal aspects, Streams, Surveys, Judicial decisions, Bank erosion, Meanders, Channels, Channel flow, Thalweg.

A creek ran between plaintiff's and defendant's property, plaintiff's land lying on the south and defendant's on the north. The creek's channel had gradually shifted toward the south so that a 1 1/4 acre tract, the subject of the dispute, lay between the original and the new channel. The crucial question was whether the boundary between plaintiff and defendant was the center of the creek's channel or its northern bank. The court stated that if the center of the channel were the boundary, the disputed tract would be an accretion to defendant's land. If, on the other hand, there were a definite boundary on the north bank, it would not be affected by the channel's shift and the property would belong to the plaintiff. The court held that the original deed set the boundary as the north bank of the stream. Therefore, the disputed tract had not accreted and belonged to the plaintiff. (Caldwell-Florida)
W71-02374

KANSAS CITY FIBRE BOX CO V F BURKART MFG CO (OWNERSHIP OF LAND BY VIRTUE OF ACCRETION).
44 SW2d 325-330 (Ark 1931).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Land tenure, *Lumber, Riparian land, Boundaries (Property), Boundary disputes, Surveys, Legal aspects, Rivers, Damages, Lumbering, Forests, Channels, Judicial decisions.

Plaintiff sought replevin of a quantity of lumber which it claimed had been cut from land belonging to it. The basis of plaintiff's claim was that the tract in question had accreted to other riparian land owned by plaintiff. Conflicting evidence was presented at trial, but the jury found for the plaintiff, rejecting defendant's contention that it held the tract by adverse possession. The appellate court held that the trial judge's instructions as to accretion and other issues presented in the case were correct. Decision for the plaintiff was affirmed. (Caldwell-Florida)
W71-02375

DALY V STATE (NO OBLIGATION RESTS ON STATE TO PROTECT LANDS THAT WOULD BE FLOODED EVEN IN ABSENCE OF STATE-CONSTRUCTED CANAL).
132 Misc Rep 92, 228 NYS 738-41 (1928).

Descriptors: *New York, *Overflow, *Discharge (Water), *Damages, Crop response, Surface waters, Canals, Channel improvement, Excavation, Canal construction, Muck soils, Embankments, Swamps, Floodwater, Flooding, Impounded waters, Landfills, Culverts, Judicial decisions, Legal aspects, Channel morphology.

Plaintiff landowner brought action against defendant state to recover damages for injury to his crops allegedly caused by the overlow of a canal constructed by defendant. The court stated that a landowner can do anything to prevent surface water from coming onto his land from adjoining lands, but he cannot collect it and discharge it in bulk on his neighbor's lands. The court found that the bulk of the water causing plaintiff's damage came from a brook initially and not the canal as charged by plaintiff. The flooding would have occurred even without the construction of the new canal. Defendant had no obligation to protect land which would have been flooded to the same extent if the canal had not been constructed. The claim of plaintiff was dismissed. (Price-Florida)
W71-02376

CITY OF NEW YORK V DYCKMAN MKT TERMINAL CORP (LANDS BETWEEN HIGH AND LOW WATER MARKS ARE CITY'S IN FEE AS PUBLIC LANDS).
130 Misc Rep 103, 224 NYS 207-209 (1927).

Descriptors: *New York, *High water mark, *Public lands, *Boundary disputes, Ownership of beds, Grants, Land tenure, Low water mark, Boundaries (Property), Judicial decisions, Legal aspects, Maps, Real property.

Plaintiff city sought to eject defendant corporation from certain lands, and contended that it owned in fee all lands lying between the high and low water marks on Manhattan Island. Defendant contended the lands in question were granted to the town of New Harlem, and plaintiff never became seized thereof. The Court of Appeal of New York had previously held that the lands between high and low water marks were not conveyed to the inhabitants of New Harlem under a certain grant, but to the city of New York under a specific charter. The issue here was whether the lands described in the complaint were located between the high and low water marks of the Harlem River. The court found that the lands so described laid inshore of the high water mark and therefore held the defendants to be owners in fee simple of the land. A verdict was directed in favor of defendants. (Price-Florida)
W71-02377

DAVISON V CITY OF ANN ARBOR (FAILURE OF PROOF THAT LOWERING OF WATER TABLE WAS DUE TO OTHER THAN NATURAL CAUSES).
237 Mich 453, 212 NE 81-83 (1927).

Descriptors: *Michigan, *Water wells, *Muck soils, *Water table, Pumping, Cities, Wells, Cultivated lands, Damages, Diversion losses, Water demand, Pumping plants, Crop response, Gravel, Percolation, Water supply, Water shortage, Water users, Legal aspects, Judicial decisions.

Plaintiff landowners sought to recover damages and to enjoin defendant city from using its water pumps. Plaintiffs contended that defendant's actions had reduced the water table on their land to the extent of making said land worthless for agricultural purposes. Defendant denied that its pumps had caused any injury to plaintiffs' property. Defendant proved to the satisfaction of the trial court, by expert testimony, that its taking of water at a depth of forty feet below the surface had no material effect on the water table on which plaintiffs relied for their water supply. The court concluded that plaintiffs had sustained no damage by the operation of defendant's pumping station and that the rescission of the flowing wells was not satisfactorily shown to have happened from other than natural causes. The judgment for defendant was affirmed. (Price-Florida)
W71-02378

ANDES V ANDES (WATER RIGHTS SUBJECT TO LEASEHOLD).
173 A 452-458 (Pa 1934).

Descriptors: *Pennsylvania, *Water rights, *Land tenure, *Water supply, Judicial decisions, Legal aspects, Adjudication procedure, Relative rights, Supply, Conjunctive use, Pipelines, Water utilization, Water sources, Use rates, Appropriations, Irrigated land, Irrigation, Damages, Greenhouses.

Plaintiff's grantor owned five coterminous lots served by springwater piped from one of them. Defendant was granted a long-term lease allowing him to use as much water from the spring as was necessary to supply his bottling plant which served a nearby city. Plaintiff was granted adjoining property with rights to the use of water passing through an existing pipe for the use of his two greenhouses and one field. Plaintiff constructed additional greenhouses and expanded his fields. Defendant began to sell water to cities other than the original one. Plaintiff brought an action for damages to his crops caused by defendant's use of all the water of the spring. Defendant answered that plaintiff's water rights were subject to his leasehold. A trial court verdict for plaintiff was reversed by the Superior Court of Pennsylvania. Plaintiff's damages should have been limited to the field and greenhouses existing at the time of his grant. Defendant was liable only to the extent that he used water from the spring for sale to towns other than the one specified in his lease. (Dye-Florida)
W71-02379

HAYS V HOFFMAN (OBSTRUCTION OF DRAINAGE DITCH ALLEGED TO HAVE CAUSED OVERFLOW).
160 SE 852-854 (SC 1931).

Descriptors: *South Carolina, *Obstruction to flow, *Ditches, *Prescriptive rights, Relative rights, Backwater, Legal aspects, Damages, Adjudication procedure, Contracts, Drainage, Overflow, Drainage practices, Drainage water, Surface waters, Surface runoff, Judicial decisions.
Identifiers: Injunction (Mandatory).

Plaintiff sought to enjoin defendant from obstructing a drainage ditch carrying surface water from plaintiff's land. The obstruction caused water to back up and overflow plaintiff's property. Plaintiff claimed a prescriptive right to have water drain from his property through the ditch onto defendant's land. Defendant denied this right, contending that the ditch was dug pursuant to a contract between himself and plaintiff. Plaintiff was alleged to have agreed to dig the ditch through defendant's land so that no water was cast thereon. However, plaintiff only dug some distance onto defendant's property and stopped. When large quantities of water overflowed defendant's land as a result, he obstructed the ditch. The court agreed with defendant, holding that no prescriptive right had been established, and allowed a counterclaim by defendant for damage to his property. (Caldwell-Florida)
W71-02380

TAYLOR V LEXINGTON WATER POWER CO (NEGLIGENT RELEASE OF FLOODWATERS FROM DAM).

163 SE 137-142 (SC 1932).

Descriptors: *South Carolina, *Dams, *Flood damage, *Impounded waters, Floods, Flow control, Public utilities, Relative rights, Riparian land, Damages, Floodgates, Pondage, Backwater, Legal aspects, Excessive precipitation, Dam construction, Adjudication procedure, Compensation, Rivers, Permits, Legislation.

Pursuant to legislative authority, defendant power company constructed a dam across a river. Before the dam was completed, heavy rainfall caused waters to back up behind the dam to a dangerous extent, and defendant opened the floodgates, damaging plaintiff's property. The court held that while the defendant had the right to build the dam, it had to pay for any damage proximately caused to surrounding landowners. This was so even though no negligence by defendant was shown. The court reasoned that because the dam was built under state authority for the public good, any damage caused by the dam was a 'taking' of private property for which compensation must be made. A lower court decision for defendant was reversed. (Caldwell-Florida)
W71-02381

FAIREY V SOUTHERN RY (RAILROAD EMBANKMENT ALLEGED TO HAVE DAMMED SURFACE RUNOFF).
160 SE 274-275 (SC 1931).

Descriptors: *South Carolina, *Embankments, *Repulsion (Legal aspects), *Riddance (Legal aspects), Railroads, Flood damage, Obstruction to flow, Floods, Ditches, Drainage, Surface runoff, Legal aspects, Surface waters, Flood waters, Drainage water, Backwater, Overflow.

In an action for damages, plaintiff claimed than an embankment of defendant railroad had the effect of damming surface runoff during periods of heavy rainfall. This caused water to back up and overflow plaintiff's property. The court dismissed the complaint, holding that the 'common enemy rule' applied. Under this rule, the railroad had the right to protect its right-of-way from surface runoff by any means possible, and any damage to the plaintiff caused thereby was not actionable. The defendant, in dealing with surface water on its own land, was not required to exercise even reasonable care to protect plaintiff from injury. (Caldwell-Florida)
W71-02382

BYRD V PENNSYLVANIA RR (OVERFLOW DAMAGE CAUSED BY PLUGGED RAILROAD CULVERT AFTER HEAVY RAINFALL).
145 SE 722-725 (Va 1928).

Descriptors: *Virginia, *Obstruction to flow, *Excessive precipitation, *Culverts, Surface runoff, Flood damage, Railroads, Embankments, Floods, Structures, Overflow, Natural flow, Adjudication procedure, Legal aspects, Judicial decisions, Overflow, Construction materials.

In an action for damages, plaintiff alleged that during a period of heavy rainfall, defendant railroad had negligently allowed a culvert under its embankment to become plugged by loose cross-ties and other construction material. This caused runoff to back up and overflow plaintiff's property. Defendant contended that it should not be held liable for damage caused by rainfall which was so heavy as not to be reasonably anticipated. The court held that there was sufficient evidence to justify submission of the case to a jury. A verdict for the plaintiff was upheld. (Caldwell-Florida)
W71-02383

BOSWORTH V NELSON (DISPUTE OVER EXISTENCE OF FISHING RIGHTS ALLEGEDLY RETAINED BY GRANTOR).
152 SE 575-581 (Ga 1930).

Descriptors: *Georgia, *Relative rights, *Easements, *Fishing, Water rights, Prescriptive rights, Water utilization, Recreation, Land tenure, Remedies, Adjudication procedure, Boating, Legal

aspects, Judicial decisions, Riparian land, Rivers, Streams, Ponds, Overflow, Public rights.
Identifiers: *Profits (A prendre).

Plaintiff was the original owner of land comprising defendant's tract and the surrounding territory. When plaintiff disposed of his property to defendant's predecessor in title and others, he reserved boating and fishing rights in the streams flowing through the properties. When defendant constructed a recreational facility along one of the streams, plaintiff sought to enjoin defendant from interfering with his retained rights. Defendant contended that plaintiff's 'rights' were void because they constituted an easement, which must be appurtenant to an estate in land. As plaintiff had retained no land, defendant argued, such easement could not exist. The court rejected this contention, holding that plaintiff's rights were profits a prendre, an estate in land which can exist by itself. The court further held that the public could not acquire such rights by prescription. The fact that plaintiff had allowed the public to use the stream for many years did not deprive him of his profit nor vest any rights in defendant. Plaintiff was held entitled to an injunction. (Caldwell-Florida)
W71-02384

HUGGINS V ATLANTIC COAST LINE RR (RAILROAD FILL ALLEGED TO HAVE CAUSED FLOODWATER DAMAGE).

155 SE 839-841 (SC 1930).

Descriptors: *South Carolina, *Railroads, *Obstruction to flow, *Floodwaters, Floods, Rivers, Flood damage, Culverts, Embankments, Backwater, Damages, Overflow, Adjudication procedure, Roads, Landfills, Alteration of flow, Excessive precipitation, Legal aspects, Structures, Judicial decisions.

In an action for damages, plaintiff alleged that during a period of high water, defendants' railroad bed had obstructed the flow of floodwaters. Such obstruction allegedly caused flood damage to plaintiff's property. Conflicting evidence had been presented at trial, some to the effect that a highway parallel to the railroad had obstructed the floodwaters. The court held that enough evidence favoring plaintiff had been presented to justify submitting the case to a jury. Since the jury had found for the plaintiff, the court declined to disturb the verdict, rejecting defendants' contention that it was entitled to a directed verdict. (Caldwell-Florida)
W71-02385

LAUMA V BUNKER HILL AND SULLIVAN MINING AND CONCENTRATING CO (EASEMENT TO DUMP WASTES).
41 F2d 358-361 (9th Cir 1930).

Descriptors: *Idaho, *Water pollution, *Riparian rights, *Easements, Legal aspects, Judicial decisions, Water pollution sources, Water pollution effects, Riparian land, Mining, Damages, Contracts, Competing uses, Wastes, Industrial wastes, Real property, Waste disposal, Mine wastes, Waste dumps.

Defendant mining company deposited wastes and debris in a stream which ran through plaintiff's property. The stream deposited the wastes on plaintiff's land, causing damage to his realty and livestock. Plaintiff sought damages under his right as a riparian owner to receive the waters of the stream in an unpolluted state. Defendant introduced an agreement between itself and plaintiff's grantor, in which plaintiff's grantor conveyed to defendant the right to dump waste and tailings into the stream. The Ninth Circuit Court of Appeals affirmed a judgment for defendant. An agreement for consideration in which a downstream riparian owner conveys the right to pollute a stream to an upstream owner creates an easement binding on the downstream owner's successors in title. (Dye-Florida)
W71-02386

LEITCH V CITY OF CHICAGO (FEDERAL JURISDICTION OF CASES INVOLVING NAVIGABLE STREAMS).
41 F2d 728-732 (7th Cir 1930).

Descriptors: *Illinois, *Federal jurisdiction, *Adjudication procedure, *State governments, United States, Jurisdiction, Judicial decisions, Legal aspects, Navigable waters, Rivers, Streams, Navigation, Damages, Mississippi River, State jurisdiction, Riparian land, Governments.

Plaintiff sought to restrain defendant city from filling in a navigable stream which passed through his land. Plaintiff claimed that the federal courts had jurisdiction, since the stream was a navigable waterway governed by federal law under the Ordinance of 1787. The Seventh Circuit Court of Appeals affirmed dismissal of the complaint. The ordinance of 1787 remains in effect only insofar as not rejected by a state. The United States relinquished control of the rivers of Illinois by legislative act. The State of Illinois assumed control of navigable rivers of the state by statute. Therefore, jurisdiction over such watercourses remains in the state until affirmatively assumed by the United States. (Dye-Florida)
W71-02387

CLARION RIVER POWER CO V SMITH (POWERS OF THE FEDERAL POWER COMMISSION).
59 F2d 861-864 (DC Cir 1932).

Descriptors: *Federal Power Act, *Electric power, *Federal government, *Administration, Federal project policy, Projects, Federal jurisdiction, Hydroelectric plants, Hydroelectric project licensing, Legislation, Legal aspects, Judicial decisions, Jurisdiction, Governments, Administrative agencies, United States, Water resources development, Electric power industry, Public utilities, District of Columbia, Regulation, Supervisory control (Power).

Plaintiff power company was a licensee under the Federal Water Power Act. Plaintiff submitted to the Federal Power Commission, as required by the Act, an estimate of its investment in the licensed project. The commission investigated and determined that plaintiff's estimate was too high. Plaintiff sought in this action a determination that the Commission was without jurisdiction to make any adjudication or order with reference to the cost of the project. The Court of Appeals of the District of Columbia affirmed the trial court's dismissal of the complaint. The Act gives the Commission the authority to investigate investments of licensees in order to determine an equitable return should a project be taken over by the government in wartime as provided by the Act. Specific provisions of the Act require one who accepts a license to submit to governmental audit and investigation. (Dye-Florida)
W71-02388

WASHBURN V CAMPBELL (PAROL PERMISSION AS MERE LICENSE TO MAINTAIN DAM).
267 Mass 285, 166 NE 861-862 (1929).

Descriptors: *Massachusetts, *Dams, *Ponds, *Permits, Ice, Streams, Boundaries (Property), Damsites, Concrete dams, Impoundments, Water storage, Land tenure, Remedies, Judicial decisions, Legal aspects, Relative rights.

Plaintiff sought to enjoin defendant from destroying a dam which had been erected by plaintiff's predecessor with oral permission from defendant's predecessor. The dam, situated in a stream which formed the boundary between the property of the two parties, had created a pond used by plaintiff in the ice business. Defendant argued that plaintiff had acquired no right to maintain the dam through the earlier agreement with defendant's predecessor. The Supreme Judicial Court of Massachusetts, affirming the trial court's decision for defendant, ruled that the parol permission given by defendant's predecessor was merely a license. Such a license was revocable at will both by defendant's predecessor and those who took title under her. The suit was dismissed. (Barker-Florida)
W71-02389

HUNTER V CLEVELAND, C C AND ST L RY (COLLECTION AND DISCHARGE OF WATER IN VOLUME PROHIBITED).
176 NE 710-712 (Ind 1931).

Descriptors: *Indiana, *Railroads, *Drainage systems, *Discharge (Water), Surface waters, Drainage, Drainage water, Ditches, Tiles, Sewers, Drains, Waste water, Septic tanks, Wells, Domestic wastes, Right-of-way, Volume, Relative rights, Remedies, Judicial decisions, Legal aspects, Natural flow, Bridges.

Plaintiff railway sought to enjoin defendants from collecting surface water, waste water, and water from septic tanks and discharging the same through a sewer drain onto plaintiff's right-of-way. Defendants, in developing a subdivision, had constructed a sewer system which emptied into a ditch constructed by plaintiff for the purpose of carrying off normal surface drainage. Plaintiff argued that defendants had so increased the volume and force of discharge as to threaten the safety of plaintiff's track ballast and bridges. Defendant argued that the water was following its natural drainage course, in no way threatened plaintiff's operations, and that plaintiff was bound to provide for drainage of the water since plaintiff's right-of-way interfered with the natural drainage. The Appellate Court of Indiana, affirming a lower decision for plaintiff, ruled that defendants had no right to collect the water and discharge it in volume onto plaintiff's property. (Barker-Florida)
W71-02390

CASHIN V CITY OF NEW ROCHELLE (DAMAGES FROM OVERFLOW OF STREAM).
256 NY 190, 176 NE 138-140 (1931).

Descriptors: *New York, *Overflow, *Flood damage, *Damages, Cities, Streams, Discharge (Water), Flooding, Riparian land, Excess precipitation, Local governments, Sewers, Drainage systems, Drainage practices, Drains, Volume, Right-of-way, Remedies, Judicial decisions, Legal aspects, Impounded waters, Land tenure, Rent.

Plaintiff landowner sought to recover damages to her property. The damages were allegedly caused by defendant city's collection and subsequent discharge of water into a stream flowing through plaintiff's property. It was argued that such discharge caused the stream to overflow and flood plaintiff's lands. Plaintiff further sought removal of an earth mound left by the city when it constructed a sewer through plaintiff's property. The trial court gave judgment for plaintiff, and defendant appealed on the measure of damages. The New York Court of Appeals, reversing the lower decision, ruled that damages for the overflow of land must be based on the difference between the rental value of such land without the overflow and the rental value with the overflow. The court further ruled that the leaving of the mound was merely a breach of condition of the right-of-way granted to defendant by plaintiff's predecessor. Such condition was for the benefit of the grantor only and gave plaintiff no claim against defendant. A new trial was ordered. (Barker-Florida)
W71-02391

BEAN V CENTRAL MAINE POWER CO (APPROPRIATION OF WATER CURRENT).
173 A 498-516 (Me 1934).

Descriptors: *Maine, *Obstruction to flow, *Prior appropriation, *Currents (Water), Riparian rights, Relative rights, Riparian land, Massachusetts, Dams, Judicial decisions, Legal aspects, Adjudica-

tion procedure, Streams, Alteration of flow, Flow, Mill dams, Structures, Mills, Competing uses, Riparian waters, Water utilization, Upstream, Downstream, Flow rates, Channel flow.

Defendant power company erected a dam downstream from plaintiffs' property, thereby decreasing the force of the current in a stream flowing through plaintiffs' land. No water-powered mills had ever been built on plaintiffs' land, but plaintiffs sought damages for the potential loss of water power resulting from the decreased current of the stream. Plaintiffs' claimed that the current was a valuable incorporeal hereditament incident to their property. The Supreme Judicial Court of Maine followed the law of the Massachusetts Colony, presumed to have been accepted by Maine, in finding for defendant. Current, as a potential source of water power, becomes property requiring compensation by a downstream taker only when it has been appropriated by the upstream owner. All riparian owners may use the current, but until some steps are taken to use it, no property interest vests. Defendant was not liable for appropriation of the current. (Dye-Florida)
W71-02392

BOSWORTH V NELSON (DISPUTE OVER BOATING RIGHTS).
158 SE 306-308 (Ga 1931).

Descriptors: *Georgia, *Non-navigable waters, *Boating, *Public rights, Relative rights, Easements, Recreation, Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Ponds, Streams, Land tenure, Structures, Transportation, Fishing, Water rights.

Plaintiff, the original owner of the land of which defendant's tract was a part, had retained boating and fishing rights in the waters on the property when he sold it to defendant's predecessor in title and others. A previous case concerning the same parties had decided that the retention of fishing rights was effective and that a temporary injunction should be granted restraining defendant from interfering with plaintiff's reserved rights. The trial court later made the injunction permanent, and on appeal defendant argued that boating rights stood upon a different footing than fishing rights. Defendant contended that the public had a legal interest in boating upon the waters concerned, either for recreation or transportation purposes. The court rejected this contention, holding that since the case concerned an artificial pond, which was not a navigable body of water, the pond could not be subjected to any public use except by plaintiff's consent. (Caldwell-Florida)
W71-02393

BALDWIN V NEAL (LIABILITY FOR OBSTRUCTION OF STREAM FLOW BY INADEQUATE PASSAGEWAYS UNDER RAILROAD BRIDGE).
80 SW2d 648-650 (Ark 1935).

Descriptors: *Arkansas, *Flooding, *Excessive precipitation., *Obstruction to flow, Damages, Flood damage, Floodwater, Floods, Rain, Rain water, Streamflow, Streams, Rainfall, Railroads, Judicial decisions, Barriers, Flow, Bridges.

In an action to recover damages, plaintiff contended that defendant railroad, in building railroad trestles across a stream, had negligently obstructed the flow of waters of such stream during periods of excessive rainfall. Plaintiff contended that such obstruction caused water to accumulate behind the railroad embankment which resulted in plaintiff's farm land being flooded. Defendant contended that its duty to provide adequate passageways for the waters of the creek did not extend to waters flowing from excessive rainfall. The court held that it was the duty of the railroad company to provide adequate passageways as would permit the flow of the stream's water, even in periods of excessive rainfall. Defendant was thus liable for the flooding damages, and the trial court's judgment for plaintiff was affirmed. (Snow-Florida)
W71-02394

LEISL V CITY OF NEWPORT (LIABILITY FOR OVERFLOW RESULTING FROM INADEQUACY OF CULVERT).
258 Ky 506, 80 SW2d 556-557 (1935).

Descriptors: *Kentucky, *Flooding, *Excessive precipitation, *Obstruction to flow, Damages, Flood damage, Floodwater, Floods, Rain, Rain water, Streamflow, Streams, Rainfall, Judicial decisions, Barriers, Flow, Culverts, Conduits, Overflow.

In an action for damages, plaintiff contended that defendant municipality negligently constructed and maintained a culvert in a creek. Plaintiff contended that the culvert was inadequate to carry off the waters of the creek in heavy rains, and that such culvert caused waters to back up upon his property, thereby flooding and damaging it. Defendant contended that its duty in maintaining the culvert was to allow for carry off of water during ordinary rains, but not during heavy rains. The court held that one constructing and maintaining a culvert in a creek not adequate to carry off the water during ordinary rains is liable in damages caused by any overflow. However, the court held that there was no liability for such overflow resulting from extraordinary or heavy rains. The court affirmed the trial court's granting of defendant's demurrer since plaintiff's complaint alleged that the overflow resulted from heavy rains. (Snow-Florida)
W71-02395

FORKNER V CHESAPEAKE AND O RY (RESTORATION OF NATURAL DRAINAGE COURSE BY CULVERT).
247 Ky 550, 57 SW2d 489-490 (1933).

Descriptors: *Kentucky, *Watersheds (Basins), *Surface drainage, *Culverts, Drainage, Surface waters, Drainage engineering, Drainage water, Surface runoff, Drainage systems, Outlets, Drains, Conduits, Judicial decisions, Flow, Natural flow, Obstruction to flow, Barriers, Railroads.

Plaintiff sought an injunction to require defendant railroad company to stop up a culvert which passed under a railroad bed and discharged drainage water upon plaintiff's property. Plaintiff contended that when the railroad was first constructed there was no culvert, but instead the embankment retained the water on the high side of the track. Plaintiff sought to force defendant to restore this condition. Defendant contended that the natural watershed of the area was such that the drainage water flowed naturally across plaintiff's property. Defendant contended that the culvert merely restored the natural drainage course which the construction of the railroad tract had altered. The court held that defendant had acted correctly in restoring the natural condition by opening up the drain under its track and in restoring the flow as it would have existed if it had never been interfered with initially. The trial court's refusal of an injunction was affirmed. (Snow-Florida)
W71-02396

REUGSEGGER V CHIGAGO GREAT WESTERN RR (LIABILITY FOR FLOODING CAUSED BY OBSTRUCTION OF A STREAM).
29 SW2d 221-223 (Mo 1930).

Descriptors: *Missouri, *Obstruction to flow, *Flooding, *Excessive precipitation, Streams, Streamflow, Flow, Floods, Floodwater, Damages, Flood damage, Backwater, Overflow, Rain, Rain water, Judicial decisions, Railroads, Rainfall, Barriers, Legal aspects, Riprap.

In an action for damages, plaintiff contended that defendant railroad company obstructed a stream by negligently piling into such stream carloads of rocks in an effort to riprap a railroad bed. Plaintiff contended that such obstruction dammed the flow of water in the stream, thereby causing it to back up and overflow onto plaintiff's land. Defendant contended that the flooding had resulted from excessive rainfall and that the creek could not have held all the water even if the rocks had not been in the stream. Defendant thus contended that the rocks were not a proximate cause of the flooding. The court stated that the issue of proximate cause was a jury question. The court in affirming, held that there was sufficient evidence to support the jury's verdict that the rock had been a proximate cause of the flooding. (Snow-Florida)
W71-02397

FRANK V DIERSON (LIABILITY FOR ALTERATION OF NATURAL DRAINAGE DIRECTION).
235 Ky 229, 30 SW2d 950-952 (1930).

Descriptors: *Kentucky, *Surface drainage, *Surface runoff, *Alteration of flow, Drainage, Runoff, Drainage water, Overland flow, Surface waters, Judicial decisions, Diversion, Flow, Natural flow, Legal aspects, Relative rights.

In an action for damages, plaintiff contended that defendant, owner of an adjoining lot, had so filled and elevated his lot so as to divert the natural drainage of surface water and to cast such upon plaintiff's lot. Plaintiff contended that prior to defendant's acts the drainage had been away from plaintiff's lot, but now surface water was cast upon plaintiff's lot, thereby causing much damage. Defendant contended that the evidence was insufficient to establish that he had altered the course of natural drainage. The court held that there was ample testimony and evidence to support plaintiff's contention. The court thus ruled that defendant was liable for damages caused by the diversion of surface water onto plaintiff's land. (Snow-Florida)
W71-02398

WALTER V WAGNER (FLOOD DAMAGE CAUSED BY LANDFILL).
225 Ky 255, 8 SW2d 421-422 (1928).

Descriptors: *Kentucky, *Surface runoff, *Landfills, *Damages, Land utilization, Flood damage, Relative rights, Land tenure, Walls, Legal aspects, Surface waters, Repulsion (Legal aspects), Riddance (Legal aspects), Adjudication procedure.
Identifiers: *Temporary.

Plaintiff and defendant owned adjacent plots of land. Defendant had filled his land, raising the surface of the property above that of plaintiff, and plaintiff had obtained a judgment against defendant for damage resulting from the runoff from defendant's property. Plaintiff subsequently sought damages resulting from another rainfall, and sought to recover the cost of building a wall capable of protecting his lot from the overflow. Defendant claimed that the former judgment was a bar to the subsequent action. The court held that the fill must be considered a temporary condition, as it could be regraded at any time. Therefore, plaintiff could bring an action for each injury suffered. It was proper for defendant to attempt to minimize damages by constructing a wall. Moreover, the fact that defendant had sold the property before the latter action was brought did not relieve defendant of liability, as defendant had created the condition in the first instance. (Caldwell-Florida)
W71-02399

KIGER V SANKO (DAMAGE CAUSED BY EXCESSIVE SURFACE RUNOFF).

1 SW2d 218-223 (Mo 1927).

Descriptors: *Missouri, *Repulsion (Legal aspects), *Surface runoff, *Riddance (Legal aspects), Surface waters, Floods, Flood damage, Ditches, Barriers, Alteration of flow, Obstruction

to flow, Drainage practices, Legal aspects, Relative rights, Drainage water, land tenure, Damages, Embankments.

Plaintiffs and defendants owned adjacent tracts of land. Originally, a ditch which ran through defendants' property channeled surface runoff over portions of the respective tracts so as to cause no damage. Plaintiffs alleged that defendants had filled this ditch and constructed new ones, resulting in large amounts of drainage being cast upon plaintiffs' property with destructive force. Plaintiffs had built an embankment along the common boundary to block flow from these ditches, but this embankment was broken by the flood waters. The court held that, while under the 'common enemy' rule a landowner had the right to rid himself of surface waters, he did not have the right to discharge water in destructive quantities onto adjacent property. The court rejected defendants' contention that the break in plaintiffs' embankment, rather than defendants' actions, had caused the damage. Plaintiffs were not required to build the embankment in the first place. Moreover, the presence of the embankment gave defendants no right to dig ditches in such a way as to cast water upon plaintiffs' land. (Caldwell-Florida)
W71-02400

ROSITZKY V BURNES (FLOOD DAMAGE TO ADJACENT BUILDING CAUSED BY OVERFLOW FROM ROOF).
295 SW 830-833 (Mo 1927).

Descriptors: *Missouri, *Drains, *Structures, *Flood damage, Obstruction to flow, Rainfall, Overflow, Pipes, Storm drains, Legal aspects, Drains, Floods, Leases, Screens, Barriers, Roofs, Land tenure.

In an action to recover water damages, plaintiff alleged that defendant had allowed gravel and other trash to accumulate on defendant's roof. During heavy rainfall, runoff from defendant's roof overflowed onto plaintiff's adjacent building, carrying with it much of this trash and clogging plaintiff's drains. Water was therefore backed up into plaintiff's building, causing flood damage. The court found that plaintiff's drains were negligently clogged. However, defendant contended that it did not occupy the premises in question, but leased it to a third party, and that under Missouri law a lessor was not liable for such damage caused while the tenant was in possession. The appellate court, however, found that there was no allegation or evidence of any lease in the record. Defendant was therefore held liable for the damage caused by the overflow. (Caldwell-Florida)
W71-02401

YOUNG V ILLINOIS CENT RR (RAILROAD EMBANKMENT ALLEGED TO HAVE OBSTRUCTED NATURAL DRAINAGE, CAUSING FLOOD DAMAGE).
220 Ky 322, 295 SW 156-158 (1927).

Descriptors: *Kentucky, *Obstruction to flow, *Overflow, *Railroads, Embankments, Drainage, Natural flow, Ditches, Barriers, Right-of-way, Rivers, Flood damage, Costs, Structures, Floods, Legal aspects, Judicial decisions, Alteration of flow, Damages, Land tenure, Surface waters, Surface runoff.

Defendant railroad had constructed an embankment over plaintiffs' land, blocking the natural drainage of the property. A ditch had been constructed parallel with the embankment to drain the property, but it had become clogged. Plaintiffs sought damages when surface runoff overflowed their property. Affirming a lower court decision for the defendant, the court held that plaintiffs could not recover as the railroad had no duty to maintain the ditch or to provide for the drainage of plaintiffs' land. The ditch was found not to be within the railroad's right-of-way, but on plaintiffs' property. No evidence was found as to who constructed the ditch, or any surrounding circumstances. Also, since plaintiffs had purchased the property after the ditch had become clogged, they were presumed to have known of the situation. There was no evidence that plaintiffs had any expectation that the railroad would maintain the ditch. (Caldwell-Florida)
W71-02402

CALDWELL V GORE (INTERSTATE SURFACE RUNOFF: LOWER SERVITUDE).
175 La 501, 143 So 387-388 (1932).

Descriptors: *Louisiana, *Natural flow, *Repulsion (Legal aspects), *Interstate, Streams, Dams, Flow, Streamflow, Arkansas, Adjudication procedure, Judicial decisions, Legal aspects, Riparian rights, Alteration of flow, Obstruction to flow, Relative rights, Drainage, Drainage water, Running waters, Downstream, Upstream, Riddance (Legal aspects).
Identifiers: *Servitudes.

Plaintiff upland owner owned property in Arkansas. Defendant lower landowner's property was in Louisiana. A stream ran from north to south through the parties' land into a lake on defendant's Louisiana property. Defendant erected a dam on his property impounding water on plaintiff's Arkansas land. Plaintiff sought to have the dam removed, claiming that under Louisiana law the proprietor of a lower estate owes a servitude to an upper estate to receive all the natural drainage therefrom. Under the common law and Arkansas law, no such servitude existed. Both parties were Louisiana residents. The Supreme Court of Louisiana agreed with plaintiff. A lower estate in Louisiana owes servitude to an upper estate in Arkansas to receive all the natural drainage therefrom. Louisiana law will be applied in an action by Louisiana residents owning property in Arkansas against Louisiana proprietors for an act done in Louisiana. (Dye-Florida)
W71-02403

ROBERTSON V BROOKSVILLE AND I RY (CONDEMNATION OF ACCESS TO WATER NECESSARY FOR RAILROAD OPERATION).

129 So 582-587 (Fla 1930).

Descriptors: *Florida, *Condemnation, *Right-of-way, *Access routes, Eminent domain, Legal aspects, Judicial decisions, Adjudication procedure, Easements, Railroad relocation, Real property, Land tenure, Railroads, Transportation, Water rights, Water supply.

Plaintiff railroad sought to condemn access to a supply of water on defendant's property. Plaintiff contended that a railroad might condemn any property reasonably necessary for its operation. Defendant contended that plaintiff had acquired no rights in the water sought to be removed, even though it had been removing it for some time without legal right. The Supreme Court of Florida reversed a trial court judgment for plaintiff. Though a railroad may condemn property necessary for its operation, such an action may not be used to accomplish a futile act. It would be futile to allow condemnation of a right-of-way to a water supply to the use of which plaintiff has no right. Defendant might first be allowed to condemn the water rights, after which right of access might be obtained by eminent domain. (Dye-Florida)
W71-02404

MEYERS V BEAUCHAMP (RIGHT OF RIPARIAN OWNER TO PROTECT HIS LAND).
51 SW2d 545-547 (Mo 1932).

Descriptors: *Missouri, *Riparian rights, *Bank erosion, Riparian land, Riparian waters, Alteration of flow, Watercourses (Legal), Beaches, Gravel, Bridges, Highways, Highway effects, Dams, Erosion, Relative rights, Natural flow, Natural flow doctrine, Judicial decisions, Legal aspects, Obstruction to flow.

Plaintiff and defendant owned land on opposite sides of a river. Plaintiff sought to enjoin defendant from placing obstructions in the river on defendant's side. Defendant counterclaimed and sought to enjoin plaintiff from placing obstructions in a similar manner on his side of the river. The court found that defendant did nothing more than protect his land from being washed away by the current as altered by plaintiff's action. Defendant had a right to protect his land against the waters of the river so long as he did so with due regard for the rights of other riparian owners and did not change the current of the stream so as to injure the banks of a lower or opposite riparian owner. The judgment below dismissing all parties' claims was affirmed. (Price-Florida)
W71-02405

HUTCHINGS V WABASH RY (UPSTREAM OWNER'S DIVERSION OF WATERCOURSE).
For primary bibliographic entry see Field 04A.
W71-02406

BRATSCHI V LOESCH (RIPARIAN OWNERS OWN TO THE CENTER OF NON-NAVIGABLE STREAMS).
51 SW2d 69-72 (Mo 1932).

Descriptors: *Missouri, *Non-navigable waters, *Boundaries (Property), *Thalwegs, Boundary disputes, Accretion (Legal aspects), Avulsion, Gravel, Legal aspects, Judicial decisions, Channel morphology, Ownership of beds, Beds under water, Real property.

Plaintiff riparian owner brought action to quiet title to a gravel bar located between the bank of the river on which his property abutted and the thread of such river. Defendant contended that plaintiff's property extended only to the bank of the river or in the alternative, that the river had undergone an avulsive change in course, and therefore the true dividing line between his property and that of plaintiff was the center of the river as it ran originally. Consequently, the gravel bar was within defendant's boundaries. The court stated that where a non-navigable stream constitutes the dividing line between two tracts of land, each owner takes to the center of said stream. Where the change in the course of the stream which forms such boundary is slow and gradual, as in the instant case, the boundary line changes with the stream, and thus the center of the stream continues to be the boundary. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-02407

FRIZZELL V LOWE (OWNERSHIP OF ISLAND IN NON-NAVIGABLE RIVER).
294 SW 996-998 (Ark 1927).

Descriptors: *Arkansas, *Islands, *Federal government, *Patents, Public lands, Non-navigable waters, Thalweg, Riparian rights, Shores, Swamps, Meanders, Land tenure, Judicial decisions, Legal aspects, Taxes, Real property, Relative rights.

Plaintiff brought action to enjoin defendant from taking timber from a small island in the Little Missouri River which she claimed through a patent from the Department of the Interior. Defendant claimed the island through a tax deed from the state. The issue was whether the United States had conveyed the tract here involved to the state through a swamp land patent of 1855. The court found that the land had been excluded from the patent, that title to the land had remained in the United States and that plaintiff was the owner of said land through the patent from the Department of the Interior. The court stated that ownership of the land opposite an island would carry with it riparian rights to the thread of the stream, which would include any ordinary island to be expected in

a non-navigable stream, but as defendant was not such an owner, he was in no position to raise the question of riparian rights. The judgment for plaintiff was affirmed. (Price-Florida)
W71-02408

CLINCHFIELD COAL CORP V COMPTON (DIVERSION OF PERCOLATING WATER).
139 SE 308-313 (Va 1927).

Descriptors: *Virginia, *Diversion, *Groundwater, *Percolating water, Percolation, Adjudication procedure, Judicial decisions, Legal aspects, Land, Land tenure, Real property, Subsurface waters, Obstruction to flow, Underground streams, Damages, Mining, Coal mines, Underground, Underground structures.

Defendant's mining shaft collapsed, obstructing the flow of groundwater beneath plaintiff's property. Plaintiff contended that: (1) defendant's shaft extended beneath plaintiff's land; and (2) the underground water flowed in a defined channel and was subject to the diversion limitations of surface streams. The Supreme Court of Appeals of Virginia reversed a trial court judgment for plaintiff. Evidence showed that defendant's shaft was entirely beneath its own property, as was the source of the diverted groundwater. Percolating water is that which may not be inferred by surface conditions to have a defined channel. An owner of land, so long as no malice is involved, may make any reasonable use of the percolating water beneath his land, even if such use results in diversion of water from the lands of others. No malice was alleged in the instant case, and there was not evidence that the water diverted was not percolating water. (Dye-Florida)
W71-02409

HARTZELL V VILLAGE OF HAMBURG (VILLAGE BOUND TO ACQUIRE WATER SUPPLY FOR PUBLIC USE BY CONDEMNATION OR GRANT).
155 Misc 345, 279 NYS 650-658 (1935).

Descriptors: *New York, *Municipal water, Dams, Governments, Artificial use, Beneficial use, Damages, Concrete structures, Obstruction to flow, Reservoirs, Legal aspects, Judicial decisions, Riparian rights, Riparian land, Streams, Natural flow, Condemnation, Compensation, Grants, Diversion.

Plaintiff riparian landowners sought to enjoin defendant village from taking the water of a stream which in its natural course flowed through the lands of plaintiffs. Plaintiffs contended that defendant had dammed the stream and diverted all of its water for the village's inhabitants' domestic uses and had damaged their lands without compensation. Plaintiffs further maintained that defendant collected considerable revenues from the sale of the water diverted. Defendant contended that plaintiffs' action was barred by laches and that defendant had acquired a prescriptive right to the water. The court held that although the village had a statutory right to acquire an adequate water supply, it was bound to acquire such supply by grant or condemnation. Although defendant took most of the stream's water for six years, it did not acquire a prescriptive right to withdraw the water without just compensation to the riparian owners. (Quesada-Florida)
W71-02410

SCHOFIELD V DINGMAN (RIPARIAN RIGHTS OF OWNERS OF LAND WHICH DOES NOT ABUT LAKE).
261 Mich 611, 247 NW 67-68 (1933).

Descriptors: *Michigan, *Banks, *Riparian land, *Easements, Remedies, Relative rights, Navigable waters, Legal aspects, Judicial decisions, Lakes, Boundaries (Property), Shores, Prescriptive rights, Riparian rights, Access routes, Real property, Land tenure, Recreation.

Plaintiff landowners filed an action challenging the claims of defendant riparian landowner to the ownership of the riparian land situated between plaintiffs' land, which overlooked a navigable lake, and the waterline. Plaintiffs contended that their vendor had conveyed to them land on a bluff overlooking the shoreline of the lake with the assurance that they had riparian rights to the land between the bluff and the waterline. Plaintiffs further claimed title to the land by adverse possession, contending that they had built certain structures upon it. Defendant contended that he had acquired the vendor's rights to the land in question upon the vendor's death. Defendant maintained that since the vendor had not conveyed the property to plaintiffs at the time of the original conveyance, the vendor had retained title to it, which had in turn passed to the defendant. The Supreme Court of Michigan held that: (1) riparian rights granted to plaintiffs whose lots were separated from the lake by intervening land gave only an easement appurtenant; (2) plaintiffs had no more than the right of access to the land for recreation; and, (3) the construction of several structures on the land was of too temporary a nature to indicate adverse possession by plaintiff. (Quesada-Florida)
W71-02411

BUSH V CITY OF ROCHESTER (LIABILITY FOR EXPULSION OF SURFACE WATERS UPON LAND OF ANOTHER BY CONSTRUCTION OF A ROAD).
255 NW 256-258 (Minn 1934).

Descriptors: *Minnesota, *Surface drainage, *Drainage water, *Surface waters, Drainage, Damages, Riddance (Legal aspects), Surface runoff, Water spreading, Overland flow, Rain water, Judicial decisions, Drainage effects, Cities, Roadbanks, Roads, Road construction, Diversion.

In an action for damages, plaintiff contended that defendant municipality in building a graded street adjacent to plaintiff's property did not provide for the drainage of surface water. As a result, plaintiff contended that excessive surface water was cast upon his property, thereby damaging it. Defendant contended that the improvement caused no additional surface water to be diverted over plaintiff's land. The court held that surface water could be expelled from one's property. The court also held that the spread and diffusion of water over adjacent land is a necessary consequence of improvements. However, the disposition of surface water must be reasonable and the injury from such disposition to adjacent owners cannot exceed the benefit derived. The court examined the evidence and ruled that it supported the conclusion that the construction of the road had caused an unreasonable diversion of surface water upon plaintiff's land. The jury verdict awarding plaintiff damages was therefore sustained. (Snow-Florida)
W71-02412

FENNEMA V NOLIN (CONSTRUCTION OF DITCH JUSTIFIED WHERE DISCHARGE OF WATER WAS ABOUT SAME AS UNDER THE NATURAL COURSE OF SAID DITCH).
212 NW 702-705 (Iowa 1927).

Descriptors: *Iowa, *Ditches, *Natural flow doctrine, *Backwater, Natural flow, Judicial decisions, Legal aspects, Dams, Outlets, Channel morphology, Channel flow, Channel improvement, Diversion losses, Diversion structures, Tile drains, Overflow, Surface waters, Accretion (Legal aspects).

Plaintiff trustees brought action to enjoin defendant from maintaining a drainage ditch on his lands and from maintaining a dam which plaintiffs alleged was located in an old water channel. Plaintiffs contended that such constructions diverted water onto defendant's land in such a way as to cause water to back up on plaintiffs' land and prevent proper drainage thereof. The court ruled that defendant was justified in constructing the ditch on his land, and thereby expediting the flow and discharge of water at about the same point where the water was naturally discharged. The evidence failed to show the backwater appreciably interfered with the free flow of water from plaintiffs' property. Neither was defendant responsible for the natural accretions or obstructions that naturally effected the closing of the old water channel even though it resulted in the backing up of water on plaintiff's lands. The judgment for plaintiff was reversed in part and modified in part. (Price-Dale)
W71-02413

PLEASANT LAKE HILLS CORP V EPPINGER (RIPARIAN RIGHTS IN LAKE WHERE BED OWNERSHIP IS IN ANOTHER RIPARIAN OWNER).
235 Mich 174, 209 NW 152-154 (1926).

Descriptors: *Michigan, *Ownership of beds, *Boundaries (Property), *Riparian rights, Beds under water, Boundary disputes, Lakes, Riparian land, Fishing, Boating, Swimming, High water mark, Low water mark, Water rights, Remedies, Judicial decisions, Legal aspects.

Plaintiff corporation sought to enjoin defendant from exercising riparian rights on a lake upon which both parties were riparian owners. An earlier decision by the Michigan Supreme Court had determined that plaintiff's predecessor was the exclusive owner of the entire lake bed. Defendant claimed that the grant to plaintiff's predecessor had reserved in defendant the right of entry onto the lake. Moreover, defendant claimed that he had established title to the narrow strip between the high and low water marks of the lake through adverse possession. The court ruled that no adverse possession had been established, and since it had previously been established that plaintiff's grantor had exclusive ownership of the lake bed, defendant had no riparian rights in the lake. The injunction was granted. (Barker-Florida)
W71-02414

CRAMER V PERINE (TITLE TO ACCRETION DETERMINED BY EXTENSION OF EXISTING BOUNDARIES).
251 NY 177, 167 NE 213-217 (1929).

Descriptors: *New York, *Boundary disputes, *Accretion (Legal aspects), *Boundaries (Property), Riparian land, Streams, Banks, Judicial decisions, Remedies, Legal aspects.

Plaintiff riparian landowner sought to eject defendant neighboring landowner from accretions formed to their lands by a stream which served as a boundary of both plots. Plaintiff claimed that the deed, to his predecessors, from the common grantor of both parties, stated that the division line of the properties was to meet the stream at a specified angle. Plaintiff contended that the old boundary line should be extended on this angle to establish the new boundary on the accretion. Defendant argued that the line should be extended from the old boundary-stream intersection point so as to meet the stream at a right angle. The New York Court of Appeals ruled that in light of the special circumstances of the controversy, title to the accretions should be determined by extending the line from the old intersection point so that it intercepted the stream at right angles. Thus, the accreted land was equally divided between the riparian owners. The lower court's judgment for plaintiff was reversed. (Barker-Florida)
W71-02415

BEECHLEY V HARMS (INJUNCTION AGAINST INTERFERENCE WITH NATURAL DRAINAGE).
332 Ill 185, 163 NE 387-389 (1928).

Descriptors: *Illinois, *Obstruction to flow, *Repulsion (Legal aspects), *Surface runoff, Drainage, Surface drainage, Natural flow, Dams, Damsites, Levees, Earthworks, Flood protection, Prescriptive rights, Barriers, Remedies, Judicial decisions, Legal aspects.

entifiers: *Servitudes.

laintiff landowners sought to enjoin defendant om maintaining a dam. The dam prevented water om draining from plaintiffs' lands onto defen-nt's property. Defendant claimed that there was natural drainage onto his land and that the dam d existed on his property for over twenty years, us giving him a prescriptive right to maintain it. he trial court found that defendant's estate was rvient to plaintiffs' properties and that defendant d increased the height of the dam. The Surpeme ourt of Illinois, affirming the lower court's ruling, ld that servient property is obligated to receive tural drainage from dominant estates. Defen-nt's act of increasing the dam's height was in op-sition to such obligation. The injunction was anted. (Barker-Florida)
71-02416

ORNICK V BETHLEHEM MINES CORP (LIA-ILITY FOR DRYING UP OF SPRINGS ESULTING FROM UNDERGROUND MIN-G).

07 Pa 264, 161 A 75-77 (1932).

escriptors: *Pennsylvania, *Springs, *Drying, Mining, Spring waters, Subsurface waters, Un-rground, Groundwater, Water loss, Dry beds, Ju-cial decisions, Coal mines, Mining engineering, egal aspects, Damages, Relative rights.

laintiff brought an action for damages based on an leged drying up of springs on his property. Plain-ff contended that defendant mining company used these springs to be dried up permanently by e removal of coal underneath plaintiff's farm. De-ndant contended that it had a legal right to move the coal and that no causal connection had een established between the drying up of the prings and defendant's mining operations. The ourt held that defendant had the right to mine the oal but that it was liable for any damages the min-g did to the surface. The court ruled that vidence to the fact that the springs dried up at the mes when mining was done directly under them as sufficient to establish a causal connection etween the mining and the drying up of the prings. The jury verdict awarding plaintiff amages was sustained. (Snow-Florida)
71-02417

LLIANCE MILLS CO V SOCIETY FOR STABLISHING USEFUL MANUFACTURES GRANTS OF FLOWAGE RIGHTS).
42 A 49-50 (NJ 1928).

escriptors: *New Jersey, *Adjudication rocedure, *Water utilization, *Relative rights, Vater supply, Water distribution (Applied), Judi-ial decisions, Legal aspects.

laintiff mill company sought to enjoin defendant ociety from granting flowage rights in a water-ourse to a third person, claiming that such grants ould interfere with plaintiff's earlier grant of such ght. Defendant moved to dismiss the equity action n the ground that the alleged interference was ompensable by damages in law. The New Jersey ourt of Chancery denied the motion to dismiss, aying that evidence on both sides should first be eard. (Barker-Florida)
71-02418

COURTER V BOROUGH OF LINCOLN PARK LOCATION OF BOUNDARY DESCRIBED AS A IVER WHEN THE RIVER CHANGES LOCA-TION).
38 A 99-103 (NJ 1927).

Descriptors: *New Jersey, *Boundaries (Property), Boundary disputes, *Dry beds, Rivers, Avulsion, Accretion (Legal aspects), River beds, Beds, Chan-nels, Judicial decisions, Cities, Taxes, Assessments, Channel morphology.

Plaintiff brought an action to determine which of two municipalities had the right to assess and collect taxes on his land. The land in question was located between a fork of two branches of a river which was the boundary of the two municipalities. The municipality west of the land contended that the eastern branch was the boundary. The eastern municipality contended that the western branch was the boundary. The evidence showed that the western branch had originally been established by the legislature as the boundary. However, the western branch had subsequently dried up and the eastern branch now carried all the water of the river. The western municipality thus contended that the boundary had shifted to the east branch of the river by reason of the western branch drying up. The court ruled that when a boundary line has been once fixed, a subsequent change in the status of the waters does not have the effect of shifting the boundaries. The western branch thus remained the boundary, and the eastern municipality could assess the property between the two branches for taxes. (Snow-Florida)
W71-02419

MAYLENDER V FULTON COUNTY GAS AND ELEC CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW).
131 Misc Rep 514, 227 NYS 209-218 (1928).

Descriptors: *New York, *Dams, *Riparian water loss, *Electric power industry, Riparian rights, Riparian land, Reasonable use, Riparian waters, Natural flow, Streams, Streamflow, Public utilities, Water storage, Flow control, Overflow, Priorities, Legal aspects, Judicial decisions, Remedies, Damages, Impoundments, Impounded waters, Obstruction to flow.

Plaintiff lower riparian owner brought action against defendant hydroelectric company for damages allegedly caused by defendant unreasonably reducing and increasing, at various times, the natural flow of a certain creek. Defendant moved to dismiss for failure to state facts showing a cause of action. The facts alleged were that the defendant for 12 years had impounded waters, thereby depriving plaintiff of his rights as a lower riparian owner, and occasionally had discharged large quantities of water. The court granted the motion to dismiss, stating that plaintiff had failed to allege legal injury or show how he was deprived of any right. The court noted that every riparian owner has a right to construct a dam and temporarily detain natural flow for rightful purposes. Each riparian owner is entitled to receive the natural flow except as occasioned by reasonable use of an upper riparian owner who is entitled to first use. (Morris-Florida)
W71-02420

LOWE V INDIANA HYDROELECTRIC POWER CO (CONDEMNATION POWER OF ELECTRIC UTILITY).
151 NE 220-226 (Ind 1926).

Descriptors: *Indiana, *Eminent domain, *Public utilities, *Damsites, Legal aspects, Judicial decisions, Remedies, Riparian land, Condemnation, Compensation, Easement, Right-of-way, Public rights, Electric power, Dam construction, Overflow, Water control, Non-navigable waters, Riparian rights, Rivers, Natural flow doctrine, Legislation.

Plaintiff electric company sought to condemn lands owned by defendant which would be overflowed by water after a dam planned by plaintiff was completed. Defendant contested plaintiff's right to condemn the land without obtaining a certificate of necessity from the state Public Service Commission. Plaintiff owned land on both sides of a non-navigable river. The court held that such ownership gave plaintiff the right to use of the water in the river unless the use damaged other property by retarding the flow or causing other injury. That right would not give plaintiff the right to submerge defendant's land, but the court held that a state statute did give the right of condemnation to and electric utility. The court ruled also that a subsequent statute requiring a certificate of necessity was not applicable to companies covered by the first statute. The trial court's judgment for plaintiff was affirmed. (Morris-Florida)
W71-02421

EAST BAY SPORTING CLUB V MILLER (OWNERSHIP OF NON-NAVIGABLE WATERS).
118 Ohio St 360, 161 NE 12-16 (1928).

Descriptors: *Ohio, *Public rights, *Non-navigable waters, *Fishing, Ownership of beds, Riparian rights, Riparian waters, Navigable waters, Streams, Lakes, Lake Erie, Watercourses (Legal), Tides, Tidal marshes, Fish management, Recreation, Fish conservation, Wildlife, Legal aspects, Judicial decisions, Remedies, Relative rights.

Plaintiff sporting club and game preserve asked that defendant fishermen be enjoined from trespassing on its property, claiming they disturbed breeding grounds and scared wildfowl. Defendants answered that they had the right to fish in navigable waters. Plaintiff's land bordered on Lake Erie, and the waters in question, a lake and two streams, were accessible from such lake. The lower court ruled for defendants, and denied the injunction. The Supreme Court of Ohio agreed the open body of water was part of the bay and thus public, but it enjoined defendants from use of the two streams. The court stated the streams were defined watercourses and did not lose that definition because the water level rose with the tide. Nor could such streams be considered navigable under the definition of water capable of use as a commercial highway. Flat-bottomed fishing boats are not commerce, and, since the streams flowed only from plaintiff's private land, they were owned by plaintiff. (Morris-Florida)
W71-02422

KLEINBERG V RATETT (CONDUIT CARRYING NATURAL STREAM UNDER PROPERTY DOES NOT CONSTITUTE ENCUMBRANCE AGAINST TITLE).
252 NY 236, 169 NE 289-290 (1929).

Descriptors: *New York, *Natural flow doctrine, *Natural streams, *Riparian rights, Legal aspects, Remedies, Riparian land, Easements, Banks, Ownership of beds, Culverts, Channels, Riparian waters, Pipes, Surface waters, Natural flow, Judicial decisions, Relative rights, Real property.

Plaintiffs sought recission of a contract to buy land on the grounds it was encumbered by an easement for a stream which passed through a culvert under the property. Defendant asked for specific performance for the sale, claiming no easement existed. The Court of Appeals of New York reversed a lower court decision granting recission, but declined to order specific performance. The court said the only rights the upper and lower riparian owners had against the property were the natural rights to have the stream flow through its ancient channel. Such a right is not an easement. The conduit which carried the stream under the property was not constructed under agreement with any other owner, nor had it existed for more than 20 years, so no one had any right to enforce maintenance of the pipe; thus there was no encumbrance on the title. (Morris-Florida)
W71-02423

CARETTI V BRORING BLDG CO (LIABILITY FOR POLLUTION OF STREAM).
132 A 619-624 (Md 1926).

Descriptors: *Maryland, *Riparian rights, *Water pollution, *Domestic wastes, Legal aspects, Judicial decisions, Remedies, Water pollution control, Water pollution effects, Water pollution treatment,

Abatement, Waste disposal, Sewage disposal, Septic tanks, Cesspools, Streams, Riparian land, Wastes, Sewage, Local governments.

Plaintiff riparian landowner sought an injunction to prevent defendant land development company from discharging sewage from its development into a stream. The development drained its sewage and waste water from 70 houses into the stream, which had turned from clear to slimy and smelly in a few years. Plaintiff also claimed increased volume was causing the stream to enlarge. Defendant contended conditions were not as bad as portrayed, and that there were other contributors to the pollution. The Maryland Court of Appeals reversed a lower court's judgment for defendant and issued an injunction. The court stated that a riparian owner has a right to receive water in its natural purity and quantity, and the fact that there was more than one polluter was no help to defendant. The court declined to rule against defendant on the quantity of water, however, and allowed defendant a reasonable time to stop pollution in order not to hamper the health of the development's homeowners. (Morris-Florida)
W71-02424

MARINE LIGHTERAGE CORP V LUCKENBACH SS CO (WHARFAGE CHARGES).
139 Misc 612, 248 NYS 71-75 (1931).

Descriptors: *New York, *Regulation, *Docks, *Tariff, State governments, Federal government, Adjudication procedure, Judicial decisions, Legal aspects, United States, Taxes, Costs, Government finance, Governments, Administration, Contracts, Piers, Supervisory control (Power), Regulation.

Plaintiff corporation sought a declaratory judgment relieving it of wharfage charges levied by defendant wharf owner. The Supreme Court of New York dismissed the complaint. Wharfage is a charge for use of a wharf by way of rent. Duty of tonnage is a tax imposed for the privilege of using a harbor, and can only be imposed by Congress. Wharves may be regulated by the state in which they are located, in the absence of congressional legislation, if state statutes doe not discriminate against interstate commerce. Defendant was entitled to exclusive use of his wharf as regulated by the state. Complete relief was available to plaintiff under the statutes relating to wharfage, and therefore plaintiff was not entitled to a declaratory judgment. (Dye-Florida)
W71-02426

VROOMAN V STATE (LIABILITY FOR FLOOD DAMAGE).
141 Misc 786, 253 NYS 268-275 (Ct Cl 1931).

Descriptors: *New York, *Damages, *Floods, *Land development, Dams, Overflow, Running waters, Flooding, Accidents, Flood damage, Legal aspects, Remedies, Judicial decisions, Structures, Flood control, Islands, Impoundments, Impounded waters.

Plaintiff landowner brought an action for damages against defendant state alleging that the raising of the surface elevation of a state-owned island caused flood damage to his upstream property. Plaintiff contended that the raised surface elevation of the island located in the river upon which his property abutted caused the river to overflow its banks when a large quantity of water flowed downstream after an ice jam. Plaintiff maintained that if the island had not been raised, the water would not have backed up, and thus no flooding would have occured. Defendant contended that there was no evidence to show that the raised level of the island caused the flooding. The court, in holding for defendant, ruled that the evidence was insufficient to warrant a finding that the raised surface elevation of the island caused the upstream flooding. (Quesada-Florida)
W71-02472

MACRUM V HAWKINS (REGULATION OF BRIDGE CONSTRUCTION).
235 App Div 370, 257 NYS 287-296 (1932).

Descriptors: *New York, *Navigable waters, *Federal jurisdiction, *State jurisdiction, Bridge construction, Bridges, Highways, Tidal waters, Obstruction to flow, Navigation, Federal government, State governments, Judicial decisions, Legal aspects, Dredging, Public benefits, Taxes, Legislation Local governments, Regulation, Supervisory control (Power).

Plaintiff taxpayers sought to enjoin the implementation of a resolution by defendant Board of Supervisors relating to the construction of certain bridges and highways. Plaintiffs contended, among other things, that the construction of the proposed bridges would interfere with the full flow of tidal waters and impede navigation. The bridges were to span navigable waters wholly within the state. The court stated that congressional approval of the construction of such bridge was not required if the plans were approved by the War Department. When the government approves such a project as was here involved, it is a lawful project even though it interferes somewhat with navigation and the full flow of tidal waters. However, Congress can compel the removal of such bridges when necessary to aid navigation. The authority of the state over waters within the state is plenary and subject only to the power of Congress to regulate interstate commerce. The judgment dismissing plaintiffs' complaint was affirmed. (Price-Florida)
W71-02473

MACRUM V BOARD OF SUP'RS (AUTHORITY OF LOCAL GOVERNMENTS TO BRIDGE NAVIGABLE WATERS).
141 Misc 358, 252 NYS 546-555 (1931).

Descriptors: *New York, *Bridge construction, *Supervisory control (Power), *State governments, Local governments, Federal government, Legislation, Administration, Judicial decisions, Legal aspects, Rivers, Navigable waters, Governments, Administrative agencies, Government finance, Navigable rivers, Highways, Bridges, Project planning, Administrative decisions.

Plaintiff taxpayers sought to enjoin the issue of bonds by defendant county board of supervisors for the construction of bridges over navigable waters of the state. Plaintiffs contended that: (1) authorization of Congress was necessary for the erection of bridges over navigable waters, (2) the ordinance authorizing the bonds was invalid as it was not authorized by special act of the state legislature, and (3) the general legislative acts regarding highways were not broad enough to authorize construction of bridges over navigable waters. The Supreme Court of New York held for defendants. The River and Harbor Appropriation Act allows construction of bridges over navigable rivers without congressional approval when the navigable portions of such rivers lie wholly within a single state. The New York constitution prohibits authorization of bridge construction by special act. The power of the state over such bridges is plenary and delegable. In the instant case the power to build bridges was properly delegated as part of the highway law which allowed counties to build bridges as part of their highway programs. (Dye-Florida)
W71-02476

A COMPARATIVE ANALYSIS OF AMERICAN AND CANADIAN GOVERNMENTAL ARRANGEMENTS FOR THE DEVELOPMENT OF REGIONAL WATER POLICY IN THE COLUMBIA RIVER BASIN,
Washington Univ., Seattle. Dept. of Political Science.
Robert Warren, and Geoffrey Wandesforde-Smith.
Available from NTIS as PB-196 116, $6.00 in paper copy, $0.95 in microfiche. Completion Report, September 1970. 306 p, append. OWRR A-031-Wash (1).

Descriptors: *Public rights, Public benefits, *Governments, *Water policy, Regions, Regional analysis, *Columbia River basin, Columbia River, *Water resources development, *Planning, *Legislation, United States.
Identifiers: Public goods, Regional planning, Environmental values, Planning personnel, Development policy, Diseconomies of scale, Federal system, State water planning, Bureaucratic behavior, Public entrepreneurship, Representation, Technological change.

Organizations created to plan and coordinate the programs of water-related agencies in the Pacific Northwest have consistently failed to induce relevant federal and state agencies to order their priorities in terms of regionally oriented criteria or significantly influence the way these units interact with one another. The study finds that contrary to widely held assumptions, long-range and finely planned regional programs involving the commitment of resources by autonomous entities can occur through entrepreneurial motivations on the part of major actors without central direction. At the same time, the system has build-in biases for continued use of the public goods presently produced by large water-agencies. There is strong resistence from these production agencies and planning personnel to the acceptance of criteria concerning the effect of water projects on the environment, urban areas and social conditions. State governments tend to underinvest in water planning and fail to act as equals with the federal government in joint planning organizations. In considering planning alternatives the study finds that the centralized control of water planning is not possible within the American political system and may be dysfunctional because of scale diseconomies. In British Columbia the Premier has used his powers to establish an integrated water resources development policy as a means to the end of overall economic development of the province. But such a model is not transferable because of differences in the distribution of authority in the two federal systems. The study concludes that the appropriate response to regional water resources development planning would be to increase the level of competition among actors rather than create a centralized mechanism. Proposed steps include stimulating state governments to act more vigorously in their own interest, better equip the existing regional agency, the Pacific Northwest River Basins Commission to carry out certain functions and establish an independent regional agency concerned with research and policy analysis.
W71-02499

MONGAUP VALLEY CO V ROCKLAND LIGHT AND POWER CO (LIABILITY FOR NEGLIGENT PREPARATION OF RESERVOIR BED).

258 NYS 731-739 (Sup Ct 1932).

Descriptors: *New York, *Reservoirs, *Beds under water, *Reservoir operation, Easements, Legal aspects, Judicial decisions, Hydroelectric plants, Damages, Dams, Reservoir storage, Reservoir design, Impoundments, Flooding, Overflow, Nuisance algae, Vegetation, Vegetation effects, Fouling, Reservoir construction, Odor, Odor producing algae, Property values.

Plaintiff landowner sought to enjoin defendant corporation from maintaining an alleged nuisance and sought damages for alleged devaluation of his property adjacent to defendant's reservoir bed. Defendant had withdrawn the water from its reservoir. Plaintiff alleged that offensive odors emanated therefrom, that defendant's action created a nuisance, that the value of his property was reduced and that such injury was due to defendant's negligent preparation of the bed of the reservoir. Defendant contended that no nuisance had been created and that due care had been exercised in preparing the reservoir bed for flooding. The court ruled that whereas the project had been authorized by the legislature, the nuisance theory could not be relied on by plaintiff. For relief to be

anted, negligence had to be shown. The court ld that plaintiff failed to bear the burden of proof he did not show that defendant had not exercised dinary care and skill in preparing the reservoir d. Plaintiff's complaint was dismissed. (Price-a)
71-02524

TY OF LAWRENCE V MACDONALD ALIDITY OF PIPELINE PERMIT ISSUED BY BLIC WORKS COMMISSIONER).
NE2d 850-859 (1945).

scriptors: *Massachusetts, *Permits, *Pipelines, avigable rivers, Regulation, Water quality con-l, Local governments, Cities, Water supply, In-es, Administrative decisions, Administrative encies, Public rights, Public utilities, Water rks, Legal aspects, Judicial decisions, Adjudica-n procedure, Oil industry.

aintiff city petitioned to quash a license granted defendant public works commission authorizing oil company to lay a pipeline in a navigable river short distance upstream from plaintiff's water pply intake. The court noted that the city had nding to challenge the license because of its sponsibility to provide a suitable water supply for citizens, although other riparian owners might t have such standing. The court also noted that tutes giving control over water supplies to the epartment of Public Health did not restrict defen-nt's authority to issue the license. However, the urt quashed the license on other grounds. (Lip-k-Florida)
71-02526

INCHESTER V BYERS (LIABILITY FOR AL-ERING NATURAL FLOW OF SURFACE RAINAGE).

6 NC 383, 145 SE 774-775 (1928).

escriptors: *North Carolina, *Diversion, *Altera-n of flow, *Surface drainage, Repulsion (Legal pects), Riddance (Legal aspects), Legal aspects, dicial decisions, Damages, Drainage, Rainfall, cessive precipitation, Surface waters, Surface ru-ff, Rain water, Natural flow, Flow, Land form-g, Landfill, Channels, Obstruction to flow, Flood-g, Flood damage.

aintiff landowner sued defendant adjoining lan-wner for flood damages to his land and house al-gedly caused by defendant's placing of dirt so as divert the natural flow of surface drainage. De-ndant contented excessive rains caused the mage. The Supreme Court of North Carolina, in firming per curiam the trial court's judgment for aintiff, stated that an owner of lower land is bliged to receive surface water which naturally ws from adjoining higher land, and the lower wner may not repel such water. However, the gher owner cannot artificially increase the natu-l quantity of water or change its natural manner flow. (Morris-Florida)
71-02527

SSEX CO V GIBSON (MEASUREMENT OF ATER RIGHTS FOR MILL USE).
30 A 846-854 (NH 1925).

escriptors: *New Hampshire, *Mills, Water ghts, *Water measurement, Rivers, Dams, Saw-ills, Mill dams, Hydraulic structures, Hydraulic achinery, Sluices, Water wheels, Closed conduits, elative rights, Reasonable use, Preferences Water rights), Water utilization, Legal aspects, Ju-cial decisions, Adjudication procedure, Water ntracts, Prescriptive rights, Flumes.

laintiff sawmill owner sued defendant gristmill wner to ascertain and enforce their respective ater rights in a river. Defendant's water rights ere derived from a deed from plaintiff's predeces-or limiting defendant's rights to the amount of water necessary to run 'three run of stones, corn cracker, and smut mill' and also limiting the width of a flume through which the water flowed. Plaintiff contended that defendant's water rights were limited to the amount of water necessary to operate the specified machinery using modern water wheels which were considerably more efficient than the old wheels. Defendant contended that he was entitled to the amount of water necessary to operate the old water wheels and whatever amount would flow through the specified flume width. Affirming the judgment for plaintiff, the court noted that there was no way of computing the water needed to run the old wheel, that the width of the flume was meaningless without any limitation on the depth and water velocity and that the conduct of both parties after the conveyance clearly indicated that they had contemplated the conversion to the more modern and efficient equipment. (Liptak-Florida)
W71-02528

MARKLE V GROTHE (COLLECTION AND DISCHARGE OF SURFACE WATER).
102 Pa Super 90, 156 A 585-587 (1931).

Descriptors: *Pennsylvania, *Riddance (Legal aspects), *Surface drainage, *Flooding, Repulsion (Legal aspects), Drainage water, Slopes, Small watersheds, Natural flow doctrine, Pipelines, Pipes, Discharge lines, Flood damage, soaking, Wetting, Judicial decisions, Legal aspects, Drainage systems, Surface runoff.

Plaintiff lower landowner sued defendant upper landowner for damages caused by discharge of surface water over plaintiff's property. Defendant excavated for clay in his brick manufacturing business. Surface water which collected in the excavations drained onto plaintiff's land. Plaintiff conceded defendant's right to repulse the surface water, but contended that spring water was also being discharged onto his land which exceeded defendant's right to repulse the water. The court observed that: (1) the upper landowner has a drainage servitude for natural drainage; (2) if unavoidable loss is sustained by the lower tenant without negligence by upper tenant in the exercise of the right to repulse surface water, there is no cause of action for the loss; and (3) the upper landowner cannot concentrate the surface water to be discharged unnaturally, thereby causing injury to the lower owner. The chancellor found that whatever damage plaintiff sustained was solely from discharge of surface water. Determining that the natural flow of surface water was not increased by defendant's actions, the court held that defendant was not liable for plaintiff's injury. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-02529

DICKINSON V NEW ENGLAND POWER CO (RELATIVE RIGHTS OF DAM OWNER AND LANDOWNER).
257 Mass 108, 153 NE 458-460 (1926).

Descriptors: *Massachusetts, *Dams, *Damages, *Relative rights, Legislation, Streams, Obstruction to flow, Flood damages, Water levels, Compensation, Easements, Flow, Land tenure, Reasonable use, Watercourses (Legal), Riparian rights, Riparian waters, Remedies, Mills, Overflow, Public rights, Legal aspects, Judicial decisions.

Plaintiffs sought to enjoin defendant power company from overflowing their lands without their consent. Defendant had constructed a dam across a non-navigable stream which occasioned the flooding of plaintiff's land above the dam. The same land and defendant had been the subject of a prior suit and petition for an injunction and compensation. The suit for an injunction had been dismissed because the dam was held to be one encompassed within a statute permitting construction of dams across non-navigable streams. The petition for compensation was dismissed as defendant was entitled to a reasonable use of the stream for lawful purposes, and the consequential injuries to petitioners' estates were not recoverable. The present suit was maintained on the theory that such flowing without compensation violated the federal and Massachusetts constitutions. The trial court sustained a demurrer to plaintiffs' bill and the Supreme Judicial Court of Massachusetts affirmed. The statute which permitted construction of such dams was consitutional and adequately protected those who suffered more than incidental damages. If plaintiffs' damages had amounted to a nuisance, they would have had a remedy at law. However, if their damage was not a nuisance, it was demnum adsque injuria. (Duss-Florida)
W71-02530

NORTHERN OHIO TRACTION AND LIGHT CO V QUAKER OATS CO (GRANT OF MILLRACE IS REAL PROPERTY, NOT AN EASEMENT).
114 Ohio St 685, 152 NE 5-10 (1926).

Descriptors: *Ohio, *Artificial watercourses, *Water contracts, *Real property, Legal aspects, Judicial decisions, Damages, Prescriptive rights, Rivers, Natural flow, Watercourses (Legal), Ownership of beds, Channels, Flow, Water levels, Canals, Water rights, Water users, Mills, Operation and maintenance.

Plaintiff oats company sued defendant railroad company for money plaintiff spent in operating a millrace that defendant had covenanted to maintain. Plaintiff had sold all its interest in two miles of the race to defendant, without warranty, reserving the right to re-enter if defendant failed to continue the flow of waters in the millrace. Defendant, who ceased to maintain the millrace after its planned use of the land failed when it could not eject other occupants of part of the area, contended that its grant was only an easement which could be abandoned at any time. The Supreme Court of Ohio, in affirming a reversal by a lower appellate court of a directed verdict for defendant, held that the millrace, as a tangible and permanent item, was real property. Therefore, defendant took an interest in land, not an easement, from plaintiff which could be abandoned. (Morris-Florida)
W71-02531

STATE EX REL CRABBE V MIDDLETOWN HYDRAULIC CO (RESERVATION OF DIVERSION RIGHTS).
114 Ohio St 437, 151 NE 653-665 (1926).

Descriptors: *Ohio, *Relative rights, *Diversion, *Land tenure, Contracts, Grants, Water utilization, Canals, Streams, Competing uses, Water rights, Water allocation (Policy), Water contracts, Remedies, Adjudication procedure, Judicial decisions, Legal aspects, Water supply.

In an action of quo warranto against defendant landowner, plaintiff state challenged defendant's diversion of water from a stream which was a feeder of a state-owned canal. Plaintiff alleged that it owned the feeder and that defendant was wrongfully diverting water from it to be used in defendant's manufacturing plant. Defendant claimed that his predecessor in title had reserved such diversion rights for himself, his heirs and assigns when the land surrounding the feeder was sold to the state over one hundred years earlier. Plaintiff argued that the reservation had been made only for the original grantor and that lands occupied by the state were presumed to be owned in fee simple. The Supreme Court of Ohio, noting the evidence of continued possession and use of the water by parties in defendant's chain of title and testimony of various offcals that the reservation was continuous, ruled that defendant's diversion was under proper authority. The court further noted that for plaintiff's claimed presumption to operate, the state must actually be in full possession, not merely claim such right while allowing conflicting rights to continue. (Barker-Florida)
W71-02532

ERBSLAND V VECCHIOLLA (JURISDICTION OF CITY TO ENFORCE ZONING ORDINANCE IN NAVIGABLE HARBOR).
313 NYS 2d 576-578 (App Div 1970).

Descriptors: *New York, *Cities, *State jurisdiction, *Navigable waters, Harbors, Reservation doctrine, Boats, Marinas, Boating, Floats, Pontoons, Zoning, Water zoning, Local governments, Legislation, Administrative agencies, Judicial decisions, Legal aspects, Regulation, Supervisory control (Power).

Plaintiff boatyard owner brought action to prohibit defendant building inspector from enforcing the municipality's zoning ordinances with respect to defendant's boatyard. The alleged violation was caused by plaintiff's floats in the harbor. Plaintiff asserted that since the harbor was navigable, his floats were beyond defendant's jurisdiction. Sustaining this contention, the court held that the navigable waters of the harbor were within the sole jurisdiction of the state, precluding defendant from enforcing the ordinance. The lower court's decision for defendant was reversed. (Hart-Florida)
W71-02533

SINCLAIR REFINING CO V KEISTER (LIABILITY FOR POLLUTION OF WATER SUPPLY BY LEAKAGE OF GASOLINE TANK).
64 F2d 537 (6th Cir 1933).

Descriptors: *Water wells, *Gasoline, *Water pollution sources, *Ohio, Storage tanks, Water pollution, Pollutants, Path of pollutants, Pollutant identification, Impaired water quality, Fuels, Oil wastes, Oily water, Wells, Underground, Percolation, Penetration, Permeability, Judicial decisions, Legal aspects.

In an action for damages, plaintiff contended that defendant oil company was liable for maintaining a defective storage tank adjacent to plaintiff's property. Plaintiff contended that leakage of gasoline from the tank percolated into plaintiff's well and polluted her water supply. Defendant contended that gasoline from the tank could not have percolated through the earth and into plaintiff's well. In a per curiam decision, the court held that the question of liability was for the jury and that there was sufficient evidence on the record to support the jury's verdict for plaintiff. (Snow-Florida)
W71-02534

TERRITORY OF HAWAII V GAY (RIGHT TO DIVERT WATERS BY OWNER OF LAND AT RIVER'S SOURCE).
52 F2d 356-359 (9th Cir 1931).

Descriptors: *Hawaii, *Diversion, *Relative rights, *Riparian rights, Irrigation water, Legal aspects, Obstruction to flow, Ownership of beds, Riparian land, Severance, Natural flow doctrine, Diversion dams, Dams, Diversion losses, Water loss, Diversion, Rivers, Flow, River flow, Judicial decisions, Natural flow, Land tenure.

Plaintiff, the territory of Hawaii, brought an action to enjoin defendants from diverting the waters of a river that flowed from its source in the mountains to the sea. Plaintiff contended that it, as a downstream landowner, had certain riparian rights to the flow of the river so as to preclude defendants from damming the river upstream and diverting its waters for irrigation purposes. Defendants, owners of the land at the source of the river, contended that under Hawaiian law and custom the water of a flowing stream belongs to the owner of the land upon which such stream originates. The court held that Hawaiian customary law governed, and thus defendants could divert the waters regardless of the claims of those downstream. The common law with its riparian righrs rules was not applied. The trial court's denial of plaintiff's injunction was affirmed. (Snow-Florida)
W71-02535

UNITED STATES V TUJUNGA WATER AND POWER CO (FORFEITURE OF RIGHTS TO PUBLIC LANDS BY FAILURE TO MEET CONDITIONS OF A GRANT).
48 F2d 689-693 (9th Cir 1931).

Descriptors: *United States, *Public lands, *Easements, *Grants, Reservoirs, Dams, Ditches, Reservoir sites, Drainage systems, Conduits, Channels, Drainage, Irrigation engineering, Federal government, Legislation, Judicial decisions, Right-of-way, Land use, Land tenure, Contracts, Adjudication procedure.

Plaintiff United States brought an action for forefeiture of a grant of an easement on public lands which had been given to defendant canal and ditch company. Plaintiff contended that it had granted to defendant the right to construct ditches and conduit lines upon certain public lands provided that defendant would construct and maintain a dam and reservoir at a given point in the ditch system. Plaintiff contended that defendant had failed to construct the dam and reservoir and that defendant must therefore forfeit its grant of the easement to build conduit lines. Defendant contended that the forefeiture should not be granted since, as a general rule, courts of equity abhor a forfeiture. The court held that the statute authorizing the government to grant rights in public lands also provided for forfeiture of such rights upon the failure of a grantee to meet an agreed upon condition. Defendant's failure to build the dam and reservoir constituted a breach of its agreement and, as such, forfeiture of its rights would result pursuant to the controlling statute notwithstanding traditional rules of equity. (Snow-Florida)
W71-02536

CORBY V RAMSDELL (LIABILITY OF OWNER OF RIVER BED FOR OBSTRUCTIONS TO NAVIGATION).
45 F2d 199-202 (SD NY 1930).

Descriptors: *New York, *Navigable rivers, *Ownership of beds, *Navigation, Ships, Navigable waters, Rivers, River beds, Admiralty, Damages, Barriers, Structures, Beds, Beds under water, Judicial decisions, Hudson River, Docks.

Plaintiff brought an action in admiralty to recover damages for the sinking of his ship. Plaintiff contended that defendant was in possession and control of property under the Hudson River and that defendant had allowed a wharf to decay and become submerged under the water which constituted an unlawful obstruction to the safe navigation of the river. Plaintiff contended that his boat struck upon the wharf and sank. Defendant contended that his predecessor in title had built the wharf and that he had never used it, and therefore he was not responsible for it. The court held that owners of land under navigable water possess rights which are subject to the public's right of navigation. Such owners have an obligation to maintain abutments into the water in such a condition that they do not endanger navigation. This obligation exists by virtue of ownership of the submerged bed and is not dependant upon the actual use of such bed. Defendant was thus held liable for the damages caused by the obstruction which he had knowingly permitted to fall into disrepair. (Snow-Florida)
W71-02537

CITY OF GOLD HILL V CALIFORNIA-OREGON POWER CO (ACQUISITION OF PRESCRIPTIVE RIGHT TO CONSTRUCT DAM).
35 F2d 317-319 (9th Cir 1929).

Descriptors: *Oregon, *Dams, *Easements, *Riparian rights, Obstruction to flow, Relative rights, Diversion structures, Streamflow, Piers, Legal aspects, Remedies, Judicial decisions, Artificial use, Municipal water, Electric power, Hydroelectric plants.

Plaintiff power corporation sought to enjoin defendant city from constructing a wingdam diagonally across the portion of a river of which plaintiff and defendant owned the opposite banks. Plaintiff contended that while defendant had at one time maintained a dam across the river, the dam had long since been washed out and never rebuilt. Plaintiff thus contended that if defendant ever had an easement, it had been abandoned since no dam was ever reconstructed. Defendant contended that it had not abandoned its easement because, while the dam was washed out, a pier which connected the dam with its bank had remained intact for a period after the destruction of the dam. The court held that the evidence sustained a finding that the easement for the dam had been abandoned but that since the statutory period had not yet run as to the pier which remained for a longer period of time, defendant could maintain a structure equivalent in size and diverting capacity to the pier. (Quesada-Florida)
W71-02538

SEWELL V ARUNDEL CORP (TAXPAYERS DO NOT HAVE STANDING TO INTERFERE WITH SUCH WORKS AS CONGRESS HAS AUTHORIZED TO IMPROVE NAVIGABLE WATERS).
20 F2d 503-504 (5th Cir 1927).

Descriptors: *Florida, *Navigable waters, *Supervisory control (Power), *Federal government, Legislation, Local governments, Water policy, Legal aspects, Judicial decisions, Remedies, Permits, Project planning, Public rights, Public lands, Bays, Land forming, Islands, Dredging.

Plaintiff taxpayers sought to enjoin defendant corporation from dredging a shipping channel in Biscayne Bay around which the city of Miami was located. Plaintiffs contended that: (1) according to agreement with the city, the excavation would result in the formation of an artificial island in the bay composed of the dredged materials, and such an island would be an obstruction to navigation; (2) the dredged island would be used by the city for industry and thus destroy the beauty of the bay; and (3) since the grant from the state of Florida to the City of Miami was void because it was not approved by the state legislature, the contract between defendant and the city was void. Defendant contended that its dredging operation was valid since it was conducted pursuant to a permit issued by the Secretary of War as authorized by Congress. The court held that plaintiffs were without standing to sue for the abatement of the nuisance in that it constituted an attempt to interfere with the lawful and ordinary execution of a contract made by authority of Congress. The court also held that while an obstruction in navigable waters is a nuisance which could be abated in a proper proceeding, Congress, having absolute dominion over navigable waters, could authorize such work as it thought necessary to improve such navigable waters. (Quesada-Florida)
W71-02539

WRIGHT V CITY OF RICHMOND (CITY'S LIABILITY FOR FLOODING CAUSED BY INADEQUATE CULVERT).
132 SE 707-709 (Va 1926).

Descriptors: *Virginia, *Culverts, *Flood damage, *Road construction, Natural streams, Roads, Cities, Local governments, Water injury, Rainfall, Cloudbursts, Surface drainage, Surface runoff, Drains, Legal aspects, Judicial decisions, Adjudication procedure, Embankments, Maximum probable flood, Damages, Remedies, Precipitation excess.

Plaintiff homeowner brought action against city for damages to plaintiff's house and property allegedly caused by defendant's negligent construction of a culvert behind plaintiff's property. Plaintiff admitted that the culvert was adequate for the normal flow of water but contended that it was insufficient to take care of the heavy rainfall usually occurring during summer, thereby causing water to back up

and flood plaintiff's property. Defendant contended that plaintiff had released it of all claims arising out of the construction and that plaintiff had failed to notify the city of the claim within six months of the first flooding. Reversing a judgment sustaining defendant's demurrer, the court held that plaintiff's release could only apply to the ordinary consequences of the construction, assuming that defendant did the work in an ordinary and reasonable manner, and did not intend to relieve defendant of its negligence. The court noted that plaintiff's delay in filing his claim would only bar recovery for the first flooding but not for subsequent flooding, notice of which was given promptly. (Liptak-Florida)
W71-02540

BLANKENSHIP V DOWTIN (ENFORCEMENT OF EASEMENT IN WATER SUPPLY ON NEIGHBORING PROPERTY).
133 SE 199-202 (1926).

Descriptors: *North Carolina, *Water supply, *Water rights, *Easements, Groundwater, Pipelines, Preferences (Water rights), Land tenure, Real property, Legal aspects, Judicial decisions, Relative rights, Water contracts, Water utilization, Domestic water, Potable water, Springs, Spring waters, Pumps, Hydraulic equipment, Remedies.

Plaintiff bought a lot at a public auction and also received the right to use the water from a spring and water pump located on his grantor's adjacent lot. Defendant later bought the grantor's lot subject to plaintiff's water rights but disconnected the pump and the water pipes, therby cutting off plaintiff's sole water supply. Plaintiff brought suit and contended that he had a valid easement in the water supply. Reversing the trial court's judgment sustaining defendant's motion for nonsuit, the court held that the only reasonable interpretation of all the circumstances, including defendant's presence at the auction where the land was expressly represented as including the rights to water supply, was that plaintiff had a valid easement in the water supply and that defendant, who bought with notice of those rights, could not disconnect the system or interfere with its use. (Liptak-Florida)
W71-02541

CITY OF PORTSMOUTH V WEISS CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY DAM WASHOUT).
133 SE 781-787 (Va 1926).

Descriptors: *Virginia, *Flood damage, *Dam failure, *Cities, Water injury, Damages, Dams, Washouts, Rainfall, Rain water, Surface drainage, Surface waters, Surface runoff, Canals, Drains, Legal aspects, Judicial decisions, Riddance (Legal aspects), Drainage water, Adjudication procedure, Local governments, Legislation, Dam construction, Remedies.

Plaintiff landowner brought an action for damages against defendant city for flood damage to plaintiff's crop of bulbs. Defendant maintained a dam on an abandoned canal and during heavy rainstorms two adjacent canals overflowed, washing out the dam and flooding plaintiff's property. Defendant demurred, contending that plaintiff failed to give the required statutory notice of claim within 30 days of the damage. Plaintiff contended that the notice statute was unconstitutional and that, in any event, the statute did not apply to cases of strict liability but only to claims based on negligence. The court upheld the validity of the statute but noted that it did not apply since defendant, under its authority to maintain the canal, did not have authority to maintain a dam, and plaintiff could recover without showing negligence. The court stated that cities have no right to collect surface water and divert of discharge it to the damage of another's property. However, the court reversed a judgment for plaintiff on procedural grounds, the trial judge having erred in not granting defendant's motion for a bill of particulars as to the damages claimed. (Liptak-Florida)
W71-02542

HARRIS MOTOR CO V PULASKI FURNITURE CO (LIABILITY FOR DAMAGE CAUSED BY REPULSION OF SURFACE WATER BY CONSTRUCTION OF BUILDING).
144 SE 414-417 (Va 1928).

Descriptors: *Virginia, *Surface runoff, *Repulsion (Legal aspects), *Buildings, Surface drainage, Surface waters, Drainage effects, Drainage water, Topography, Riddance (Legal aspects), Drains, Damages, Water injury, Construction, Legal aspects, Judicial decisions, Reasonable use, Relative rights.

Plaintiff and defendant owned adjoining lots on which each constructed a building. Defendant's building obstructed the natural drainage of surface water from plaintiff's property. Plaintiff brought action for damages to his building caused by the resulting accumulation of surface water on his property. Plaintiff admitted that surface water is a common enemy but contended that defendant was unreasonable and negligent in exercising his rights. Affirming the trial court's judgment sustaining defendant's demurrer, the court held that plaintiff's evidence failed to show that defendant had acted in a careless or unreasonable manner since defendant had not altered the natural grade or contour of the property but merely erected a proper building as plaintiff himself had done. (Liptak-Florida)
W71-02543

GEORGIA POWER CO V MOORE (LIABILITY OF POWER COMPANY FOR MAINTAINING NUISANCE).
170 SE 520-525 (Ga 1933).

Descriptors: *Georgia, *Obstruction to flow, *Dams, *Water injury, Barriers, *Riparian rights, Water rights, Judicial decisions, Legal aspects, Dam construction, Flood damage, Dam falure, Earth dams, Public utilities, Hydroelectric power, Backwater, Hydroelectric plants, Dam design, Remedies, Impoundments, Impounded waters.

Defendant power company purchased and repaired a dam. Plant operations were abandoned when a gate feeding the power dam was closed. Subsequently, water backed up the river above the dam, and as a result the creeks and ditches in and below plaintiff upstream landowner's property were filled with mud and sand. The flow of the creeks and ditches was hindered, rendering plaintiff's lands unfit for cultivation. Plaintiff brought a nuisance action, alleging that defendant raised the height of the dam which resulted in the water backup and land damage. Defendant contended that any damage caused by the dam maintenance or construction had been occurring for more than four years prior to institution of the suit and that therefore the suit was barred by the statute of limitations. Defendant further contended that a request to abate, which is a prerequisite to a nuisance suit, was not made. The Court of Appeals of Georgia, in affirming for the trial court's judgment for plaintiff, held that defendant's actions created a fresh nuisance not barred by the statute of limitations. The court stated that a request to abate was not a prerequisite since defendant had knowingly acted to maintain the nuisance. (Powell-Florida)
W71-02544

FRAZIER V LEE (EASEMENTS FOR WATER SUPPLY).
178 SE 722-724 (Ga 1935).

Descriptors: *Georgia, *Easements, *Water rights, *Water supply, Land tenure, Wells, Pipes, Domestic water, Damages, Judicial decisions, Legal aspects, Usufructuary right, Relative rights, Remedies, Adjudication procedure.

Plaintiffs sought an injunction and damages against defendants for interference with plaintiffs' water rights. Plaintiffs obtained their water supply from a windmill located on land adjacent to plaintiffs' which was under control of defendants. Plaintiffs alleged they had a easement in the water which had been obtained for valuable consideration. The grant of water rights had been obtained in a parol agreement with plaintiff wife's father. Plaintiffs alleged that this agreement was a covenant running with the land which would not be interfered with by successors in title. The court reversed the trial court's denial of defendants' demurrer. Plaintiffs' action was against defendants as mere wrongdoers in the commission of acts injurious to water pipes located on the adjacent land and in forbidding plaintiffs to repair the injury, defendants being without interest in the land. However, plaintiffs' alleged right in the property on which the pipes were located on the theory of an easement was not sufficiently evidenced by the allegations, which indicated a personal covenant only, permitting plaintiffs to obtain water but not imposing a burden on the land in the nature of an easement. (Duss-Florida)
W71-02545

RHINES V COMMISSIONERS OF CHATHAM COUNTY (COUNTY'S LIABILITY FOR OVERFLOWING LAND).
179 SE 140-141 (Ga 1935).

Descriptors: *Georgia, *Eminent domain, *Surface drainage, *Remedies, Outlets, Streams, Land tenure, Administrative agencies, Damages, Overflow, Canals, Roads, Drains, Construction, Maintenance, Bridges, Rainfall, Abutments, Legal aspects, Judicial decisions, Local governments, Obstruction to flow, Excessive precipitation.

Plaintiff sought damages from defendant county commissioners, alleging that defendant had appropriated his land for public purposes by defectively constructing a drain which backed up water onto his property. Defendants had constructed a drainage outlet for a creek which allegedly was too small. Heavy rainfall backed water onto plaintiff's land, damaging the land and its buildings. The trial court sustained a demurrer to plaintiff's petition, and the Court of Appeals of Georgia affirmed. The court ruled that plaintiff had failed to state a cause of action. Defendant's acts did not constitute an appropriation of plaintiff's property for public purposes but instead constituted a negligent backing up of water resulting from defective or negligent construction of the improvement. This amounted to an abatable continuing nuisance for which the county was not liable. It is only where property has been damaged by the erection of a public improvement that the owner can recover under the theory that his property was appropriated for public purposes. One judge dissented. (Duss-Florida)
W71-02546

WHITTINGTON V CITY OF BEDFORD (LIABILITY FOR FLOOD DAMAGES CAUSED BY DAM CONSTRUCTION),
210 NW 460-461 (Iowa 1926).

Descriptors: *Iowa, *Dams, *Water levels, *Flood damage, Overlying proprietor, Riparian rights, Rivers, Damages, Judicial decisions, Legal aspects, Riparian land, Relative rights, Competing uses, Diversion, Alteration of flow, Obstruction to flow, Cities, Adjudication procedure, Remedies.

Plaintiff brought suit against defendant city for the erection of a dam downstream from her property which allegedly set back the water of the stream, thereby causing damage to her property by flooding. Defendant conceded at trial that the increase in the height of the water in the river was a technical invasion of plaintiff's rights, but contended that this, without more, would only entitle her to nominal damages. The jury was instructed that any swelling of a stream over its banks by the construction of a dam upon lower real estate is an invasion of the rights of the owner of the upper land who has

the right to the stream in its natural condition. The court found all questions to be merely those of fact for which no disturbance of the lower court's judgment for defendant was necessary. (Barnett-Florida)
W71-02547

KELLOGG V ILLINOIS CENT RR (VALIDITY OF EASEMENTS OVER MORTGAGED LANDS).
213 NW 253-257 (Iowa 1927).

Descriptors: *Iowa, *Railroads, *Easements, *Watercourses (Legal), Judicial decisions, Legal aspects, Bridges, Structures, Crops, Overflow, Right-of-way, Relative rights, Competing uses, Embankments, Damages, Diversion.

Plaintiff brought suit to foreclose a mortgage and to set aside a release and conveyance given by the mortgagor after the execution of the original mortgage. The release gave defendant railroad permission to construct and maintain roads, to divert the flow of water, and to flood the mortgagor's land without liability for damages to crops. This was in addition to defendant's pre-existing easement which allowed maintenance of a bridge and right-of-way across the land. Plaintiff contended that the release executed after execution of the mortgage was inferior to his mortgage claim and that it was an impairment of his security. The Supreme Court of Iowa affirmed a lower court's decision for plaintiff, finding that the grant of the easement to construct and improve the railroad line and to divert the water flow was an impairment of security and thus inferior to plaintiff's equitable lien on the property. (Barnett-Florida)
W71-02548

LYNCH V MINNESOTA POWER AND LIGHT CO (MEASURE OF DAMAGES FOR FLOOD INJURY TO FARMLAND).
219 NW 459-461 (Minn 1928).

Descriptors: *Minnesota, *Damages, *Compensation, *Flooding, Adjudication prodedure, Dams, Flood damage, Saturation, Soaking, Crops, Hay, Crop production, Turf, GRASSES, Depreciation, Judicial decisions, Legal aspects, Water injury.

Plaintiff farm owner sued defendant power company for flood injury to plaintiff's farm. The trial court permitted damages for loss of crops and for permanent injury to plaintiff's sod. Defendant contended that this award resulted in duplication of damages. The court noted that the general rule for crop damages is the value of the crops at the time and place of destruction, in lieu of loss of rental value. The court further determined that if a permanent diminution in land value was caused, then additional compensation should be permitted for this depreciation. Holding that duplication of damages had not occurred, the court affirmed the lower court's decision for plaintiff. (Hart-Florida)
W71-02549

NEKOOSA EDWARDS PAPER CO V RAILROAD COMM'N (AUTHORITY OF STATE TO REGULATE NAVIGABLE STREAMS).
228 NW 144-147 (Wis 1929).

Descriptors: *Wisconsin, *Regulation, *Dam construction, *Navigable waters, State governments, Navigation, Federal government, Streams, Legal aspects, Judicial decisions, Administration, Governments, Legislation, Running waters, Non-navigable waters, Riparian rights, Public rights, Relative rights, Recreation, Supervisory control (Power), Permits.

Plaintiff appealed an order of defendant Railroad Commission which denied plaintiff a permit to construct a dam in a floatable stream. Plaintiff contended that: (1) the stream was not navigable, (2) it had the right as a riparian owner to build a dam whether the stream was navigable or not, and (3) the state lacked the authority to regulate the use of streams. The Supreme Court of Wisconsin affirmed that trial court's judgment for defendant. A navigable stream is one navigable, such stream continues to be considered as navigable although it is no longer used for commerce. It is the state's duty under the Ordinance of 1787 and subsequent statutes to regulate construction of dams in navigable streams and to keep them free for navigation. (Dye-Florida)
W71-02550

NEKOOSA EDWARDS PAPER CO V RAILROAD COMM'N (RIGHT TO OBSTRUCT NAVIGATION).
229 NW 631-632 (Wis 1930).

Descriptors: *Wisconsin, *Riparian rights, *Administrative agencies, *Relative rights, State governments, Public rights, Navigable waters, Obstruction to flow, Legal aspects, Judicial decisions, Dams, Streams, Running waters, Structures, Navigation, Administration, Legislation, Regulation, Supervisory control (Power).

Plaintiff appealed a judgment affirming denial by defendant Railroad Commission of a permit allowing plaintiff to construct a dam across a navigable stream. Plaintiff contended that as a riparian owner before 1911, when a statute vested defendant with authority to allow or deny such construction, it had a vested property right to obstruct navigation which could not later be taken from it. In affirming the judgment for defendant, the Supreme Court of Wisconsin stated that no right to obstruct navigation vests in a riparian owner until a dam has been lawfully built. (Dye-Florida)
W71-02551

HANNA V OLIVER IRON MINING CO (RIGHT TO MAINTENANCE OF WATER LEVEL OF LAKES).
250 Mich 505, 230 NW 900-902 (1930).

Descriptors: *Michigan, *Lakes, *Water levels, *Cities, Local governments, Water supply, Legal aspects, Judicial decisions, Water level fluctuations, Fluctuation, Reservoir management, Height, Land, Real property, Relative rights, Industries, Water resources, Water table, Water works, Surface waters.

Plaintiff owned land situated on a lake used as a source of water by defendant city. The removal of water for domestic purposes significantly lowered the level of the lake. After the level of the lake had declined, plaintiff platted and subdivided her land. Subsequently defendant city became concerned over the lowered level of the lake and contracted with defendant mining company for the pumping of additional water into the lake. This supplementation of the natural sources of water to the lake caused the water level to rise, rendering several of plaintiff's newly platted lots unfit for habitation. Plaintiff sought to enjoin defendant mining company from pumping further water into the lake, contending that the lake was thereby raised above its natural level. The Supreme Court of Michigan affirmed a judgment for defendants. The water in the lake was raised above its level at the time plaintiff platted her property, but the evidence showed that the water was still below its level before construction of defendant city's waterworks. (Dye-Florida)
W71-02552

HENRY V CHICAGO, B AND O RR (PROXIMATE CAUSE OF FLOOD DAMAGE).
235 NW 394-396 (Wis 1931).

Descriptors: *Wisconsin, *Surface drainage, *Bridges, *Obstruction to flow, Streams, Mississippi River, Drainage, Surface runoff, Railroads, Highways, Judicial decisions, Legal aspects, Floods, Flooding, Land, Real property, Crops, Damages, Streamflow, Corn (Field), Structures, Bridge construction, Flood damage, Water injury.

Plaintiff owned farm lands in a narrow valley. North of plaintiff's land was a highway bridge. A stream flowed under the bridge and into a small ditch on plaintiff's property. Defendant railroad maintained a bridge south of plaintiff's land beneath which the stream passed. In a period of heavy rainfall, plaintiff's lands were flooded, therby damaging his crops. Plaintiff sought damages, contending that the opening beneath defendant's bridge was inadequate to allow free flow of the stream, with the result that water was backed up on plaintiff's property. The Supreme Court of Wisconsin reversed a judgment for plaintiff, finding that the opening under defendant's bridge was of a greater capacity than both the highway bridge and the ditch through plaintiff's property. The railroad bridge was capable of handling all water passing beneath the highway bridge and was thus not the proximate cause of plaintiff's injury. (Dye-Florida)
W71-02553

FLAMBEAU RIVER LUMBER CO V CHIPPEWA AND FLAMBEAU IMPROVEMENT CO (COMPANY AUTHORIZED TO OBSTRUCT RIVER FLOW LIABLE FOR EXCEEDING AUTHORITY).
236 NW 679-684 (Wis 1931).

Descriptors: *Wisconsin, *Reservoir operation, *Water levels, *Obstruction to flow, Lumbering, Impounded waters, Alteration of flow, Judicial decisions, Legal aspects, Discharge (Water), Electric power, Hydraulic structures, Dams, Saw mills, Navigation, Navigable waters, Water rights, Reservoirs, Relative rights, Damages, Administrative agencies.

Defendant improvement company, incorporated to improve navigation and river flow, was authorized by statute to obstruct streams through dam construction. Defendant, by operating certain dams, reduced the water level of a river. Plaintiff lumber company abandoned two log drives and ceased operation because of the reduced water level in the river. Plaintiff brought an action for damages and injunctive relief. Plaintiff, whose financial operations in the twelve years preceding this action included gains and losses, alleged loss of profits because of the abandoned log drives. Defendant argued that it was a state agent and as such was immune from liability. The Supreme Court of Wisconsin held that defendant was liable for wrongful acts in exercising or exceeding authority since it was not performing a governmental function. The court held, however, that damages for plaintiff's lost profits were remote and speculative which precluded recovery. The court reasoned that because of the nature of the logging business, the loss of profits might have been occasioned by other factors. Furthermore, if plaintiff had not abandoned all attempts to drive logs, sufficient water might have been furnished. (Powell-Florida)
W71-02554

ROSEMA V CONSTRUCTION MATERIALS CORP (MOORING RIGHTS OF RIPARIAN OWNER ON NAVIGABLE RIVER).
258 Mich 457, 243 NW 24-25 (1932).

Descriptors: *Michigan, *Navigable waters, *Riparian rights, *Reasonable use, Judicial decisions, Legal aspects, Docks, Water rights, Ships, Rivers, Riparian land, Riparian waters, Remedies, Prescriptive rights, Relative rights.

Plaintiffs owned waterfront property on a navigable river. Defendant corporation constructed a dock on its adjoining waterfront property. Defendant daily docked one of its boats alongside its wharf near plaintiffs' property line so that the boat partially projected out into the water in front of plaintiffs' land. Plaintiffs brought an action for injunctive relief, alleging that defendant had no right to moor its boats continually in front of plaintiffs' property. Plaintiffs expressed fear that defendant might claim prescriptive rights to the use of plaintiffs' waterfront. The Supreme Court of Michigan, in reversing the trial court's judgment for plaintiffs,

ield that defendant could moor its boat beside its wharf, even though such mooring over-lapped onto plaintiffs' premises, provided that reasonable access to plaintiffs' land was not obstructed. The court stated that a navigable river is a public highway, navigable in a reasonable way by everyone. The court ruled that defendant could not have acquired a prescriptive right, and therefore plaintiffs' were not entitled to an injunction. (Powell-Florida)
W71-02555

BOARD OF ROAD COMM'RS V MARKLEY (LIABILITY FOR DAMAGES FROM NEGLIGENT DAM CONSTRUCTION).
260 Mich 455, 245 NW 496-498 (1932).

Descriptors: *Michigan, *Dam construction, *Dam failure, *Damages, Construction materials, Dams, Damsites, Dam design, Foundation failure, Washouts, Highways, Culverts, Administrative agencies, Earth materials, Frozen ground, Thawing, Remedies, Costs, Adjudication procedure, Judicial decisions, Legal aspects, Repairing, Dam foundations.

Plaintiff board of commissioners sought to recover damages to a highway caused when defendant's dam collapsed. The dam had been constructed while the earth used for fill was frozen, and when the ground thawed, the pressure of the retained waters caused the collapse. The highway below the dam site was washed out and sections of a concrete culvert were destroyed. The trial court awarded damages to plaintiff. In affirming, the Supreme Court of Michigan ruled that evidence showing the use of frozen earth in dam construction was sufficient to justify a claim of negligent construction proximately causing damage to the highway. The court further held that the measure of damages was a reasonable amount and that evidence of the exact amount spent on repair was admissible in determining such reasonable amount. (Barker-Florida)
W71-02556

CITY OF MADISON V SCHOTT (TITLE TO BED OF NAVIGABLE LAKE).
247 NW 527-530 (Wis 1933).

Descriptors: *Wisconsin, *Ownership of beds, *Navigable waters, *State governments, Governments, Local governments, Cities, Beds under water, Lakes, Meanders, Remedies, Surface waters, State jurisdiction, Adjudication procedure, Judicial decisions, Legal aspects.

In an action to abate alleged nuisances in a lake within the city limits, the city of Madison claimed that title to the lake was held jointly by it and the state in trust for the public. The alleged nuisances consisted of land fill and docks erected by defendants who had no claim of riparian ownership. Defendants claimed that no cause of action was stated since the state was not a party to the suit. The Supreme Court of Wisconsin ruled that title to the bed of the navigable lake was vested in the state in trust for the public, and without the state as a party to such a suit, no action could lie. (Barker-Florida)
W71-02557

WILLIE V MINNESOTA POWER AND LIGHT CO (LIABILITY FOR FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).
For primary bibliographic entry see Field 04A.
W71-02558

STATE V SWEET LAKE LAND AND OIL CO (TITLE TO NON-NAVIGABLE LAKE).
164 La 240, 113 So 833-839 (1927).

Descriptors: *Louisiana, *Lakes, *Swamps, *Ownership of beds, Legal aspects, Judicial decisions, Remedies, State governments, Legislation, Land reclamation, Marshes, Surface waters, Tidal marshes, Navigation, Non-navigable waters, Navigable waters, Highways, Patents, Beds under water.

Plaintiff state sued to obtain title to the bed of an 1,800-acre lake which was located in the middle of 58,000 acres of land owned by defendant company. Defendant's title derived from three state patents. The patents included the lake area, but plaintiff claimed the lake was navigable when Louisiana became a state and thus was not subject to sale. Alternately, plaintiff argued that if the lake was not navigable, it was acquired by the state under the Swamp Land Grants of 1849 and under an 1855 act could not be sold for less than $1.25 an acre. Defendant claimed the lake was never navigable and that it was sold to defendant's predecessor in title under an 1880 act which allowed sale of the whole area for 12 1/2 cents an acre. The Supreme Court of Louisiana, in affirming a decision for defendant, held the lake was not navigable in 1812. It was surrounded by swampland until defendant's predecessor in title started reclaiming the land and built a canal to the lake. The lake had never been used for commerce, and since it was not susceptible to use for commerce, the lake was not navigable in fact, thus not in law. The court held further that the 1880 act superseded the 1855 act. (Morris-Florida)
W71-02559

COLUMBUS AND GREENVILLE RY V TAYLOR (RIGHT OF RAILROAD TO OBSTRUCT SURFACE DRAINAGE).
115 So 200-201 (Miss 1928).

Descriptors: *Mississippi, *Surface drainage, *Repulsion (Legal aspects), *Obstruction to flow, Riddance (Legal aspects), Surface waters, Surface runoff, Embankments, Drainage, Natural flow, Flow, Flooding, Railroads, Right-of-way, Civil engineering, Engineering structures, Condemnation, Legal aspects, Judicial decisions, Damages, Relative rights.

Plaintiff landowner sued defendant railroad company for damages suffered when the natural surface drainage of his land was blocked by an embankment which was built for defendant's railroad tracks. Defendant contended the jury was improperly instructed that there would be liability regardless of whether the railroad bed was constructed properly or improperly. The Supreme Court of Mississippi, in reversing a lower court verdict for plaintiff, held that the jury was instructed incorrectly. Whenever a railroad acquires a right-of-way for its track by purchase or condemnation, it also obtains exemption from liability to adjacent landowners for damages resulting from proper construction and maintenance of the track bed. A railroad, however, cannot build a track bed so as to obstruct surface waters if another equally conveneient and inexpensive method would not so obstruct the natural drainage. The court held that surface waters, subject to that exception, are a common enemy and may be repelled without liability. (Morris-Florida)
W71-02560

MONEY V WOOD (STATE SALE OF LAND UNDER NAVIGABLE WATERS).
118 So 357-360 (Miss 1928).

Descriptors: *Mississippi, *Ownership of beds, *Navigable waters, Legal aspects, Judicial decisions, Remedies, Public rights, State governments, Administrative agencies, Legislation, Shores, Beds under water, Lands, High water mark, Low water mark, Islands, Landfills, Navigation, Real property.

Plaintiff landowner sought an injunction to prevent defendant from erecting an artificial island, with hotels and houses thereon, in the Mississippi Sound in front of plaintiff's home. Defendant contended that he had valid title to the submerged land from the state land commission. The Supreme Court of Mississippi, in affirming the issuance of the injunction, declared that the title allegedly passed by the state was void. The land commissioner acted under a statute allowing sale of state-owned land, but the court ruled that the statute should be construed, if possible, to fit under the constitutional provision forbidding permanent obstruction of navigable waters. The court noted that lands between the high and low tide marks were to be held in trust for the people of the state and not sold for private use, though some states allow such sale. The court further construed the word 'land' to mean dry land rather than land under water so that the statute in question would not authorize the sale. (Morris-Florida)
W71-02561

HAVARD V STATE (RIGHT TO CONTROL OF BEDS UNDER WATER).
124 So 912-914 (Ala 1929).

Descriptors: *Alabama, *Prescriptive rights, *Ownership of beds, *Public rights, Bayous, Beds under water, Legal aspects, Judicial decisions, Remedies, Navigable waters, Bodies of water, Oysters, State governments, Riparian land, Riparian waters, Roads, Shores, Boundaries (Property), Access routes, Adjudication procedure.

Plaintiff, lessee of a landing on a bayou containing oyster beds, brought a trespass after warning action against defendant for use of the landing and water over the oyster beds. Defendant countered that plaintiff did not possess the areas in question, and therefore could not maintain the action. The Court of Appeals of Alabama, in reversing a verdict against defendant, held that the title to the beds and bottoms of all rivers, bayous, lakes and inlets rests in the state in trust for the people. The state could lease oyster beds, but it had not in the instant case, and thus plaintiff had no possessory claim. Since a warning against trespass could not be made for an area larger than the area the person giving the warning possessed, plaintiff's warning was of no effect. The court also indicated that the public had acquired a prescriptive right to use of the public road to the landing, and in such a case the ownership of the shore was subject to the public's right of access to the water's edge. The public had also acquired a prescriptive right to use of the landing. (Morris-Florida)
W71-02562

KILLGORE V COLE (LIABILITY FOR OBSTRUCTION TO FLOW OF STREAM).
126 So 861-862 (Ala 1930).

Descriptors: *Alabama, *Obstruction to flow, *Natural flow, *Riparian rights, Riddance (Legal aspects), Diversion, Remedies, Damages, Drainage, Streams, Surface waters, Dams, Impounded waters, Lakes, Fishing, Damsites, Channels, Flow, Ditches, Rainfall, Water levels, Surface runoff.

Plaintiff upper landowner brought suit to enjoin the maintenance of an alleged private nuisance created by obstruction of the natural flow of water by defendant lower landowner. Plaintiff's and defendant's lands were drained by a stream traversing their properties. Defendant built a dam upon the stream, thereby impounding the waters and creating a lake upon his property. Plaintiff alleged that the dam caused the stream to back up, eddy in the channel and overflow its banks in time of freshets, thereby causing improper drainage of plaintiff's lands. The Supreme Court of Alabama affirmed the lower court's decision for defendant. The court found that by successive lowerings of the dam and spillway, the body of the lake was withdrawn sufficiently, that the flow of water was unobstructed and that no substantial injury resulted to plaintiff as a result of maintenance of the dam. (Barnett-Florida)
W71-02563

CITY OF MOBILE V LARTIGUE (SERVIENT LAND MUST ACCEPT ONLY WATER FLOW-

ING NATURALLY THERETO FROM DOMINENT ESTATE).
127 So 257-261 (Ala 1930).

Descriptors: *Alabama, *Surface drainage, *Surface runoff, *Flow augmentation, Airports, Cities, Surface waters, Natural flow, Natural flow doctrine, Flooding, Floodwater, Ditches, Damages, Judicial decisions, Legal aspects, Topography, Overflow, Drainage, Drainage practices, Discharge (Water), Local governments.

Plaintiff landowner sought damages from defendant city for injury to plaintiff's property which resulted from the increased flow of surface water from defendant's dominant land to plaintiff's servient land. Such increased flow was caused by defendant's improvement of the natural drainage. Defendant contended any injuryresulting was noncompensable as defendant was operating within its governmental capacity. The court ruled that defendant had been operating in its corporate capacity and that defendant would therefore be governed by the same principles that govern private corporations. The servitude of a lower tenement to a dominent tenement, with reference to surface waters, extends only to surface waters flowing in their natural channels, and does not authorize the proprietor of the dominent tenement to collect the water into drains or artificial channels and precipitate it in increased quantity and volume onto the lower land to its injury. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-02564

PEOPLE V FOOTE (STATE OWNERSHIP OF BEDS).
242 App Div 162, 273 NYS 567-582 (1934).

Descriptors: *New York, *Ownership of beds, *Harbors, *State governments, Legal aspects, Judicial decisions, Boundary disputes, Public rights, Patents, Navigable waters, Governments, Reservation doctrine, Political aspects, Beds, Legislation, Real property, Beds under water.

Plaintiff people of New York sought a declaration of their rights to certain beds under a large bay as against defendant landowner. Plaintiff contended that while defendant's heir had established title from the Indians and the Dutch colonialists, his predecessor in title had applied for a confirmatory grant from the English colonial governor and thus divested himself of all title except that specifically identified in the confirmatory grant. Plaintiff thus contended that since the confirmatory grant did not include the beds in question, the beds passed to the colonial government and then to the state of New York. Defendant contended that his heir had established title from the Indians and the Dutch government and that this title had passed to him in an unbroken chain of title. The court held that: (1) a grant from a sovereign is strictly construed against the grantee; (2) a deed from Indians is not a legal source of title; (3) the application by defendant's predecessor for a confirmatory grant from the English colonial government constituted a surrender of all previous title to the government; and (4) the grantee took title only to the lands specifically described in the grant. (Price-Florida)
W71-02565

STATE V JEFFERSON ISLAND SALT MINING CO (DAMAGES FOR TRESPASS ON LAKE BEDS).
183 La 304, 163 So 145-170 (1935).

Descriptors: *Louisiana, *Lake beds, *Ownership of beds, *Mining, Navigable waters, Riparian rights, Leases, High water mark, Water levels, Mineralogy, Salts, Saline lakes, Rivers, Streams, Riparian land, Outlets, Public rights, Damages, Legal aspects, Judicial decisions, Land tenure, Marshes, Appropriation, Adjudication procedure.

Plaintiff state sought damages from defendant salt company for trespass onto state property. Defendant was lessee of land bordering a lake and had mined salt from the bed of the lake. Plaintiff alleged that title to the bed was in the state. Defendant's lessor intervened in the suit and alleged ownership of the bed to the center of the lake. Plaintiff contended that the intervenors were liable with defendant for the trespass. The trial court found for plaintiff, and the Supreme Court of Louisiana affirmed and amended. Disposition of the case depended on: (1) the navigability of the lake; (2) the legal consequences of navigability; (3) the ordinary high water mark of the lake; (4) the extent of the trespass; (5) the quantity of salt removed; (6) the good faith of defendant; and (7) the amount of damages. The court held that the lake was navigable because it was navigable at the time of the Louisiana Purchase. Title to beds of navigable waters is in the state. Ownership of beds extends from the mean high water mark, and the court ruled that the trial court had fixed this mark at too low a level. The court found that defendant's trespass was willful, and stated that the amount of damage for willful trespass of minerals is the value of the minerals taken. Finally, the court held that the lessors and lessee were jointly liable for the trespass. (Duss-Florida)
W71-02566

YOUNG V INTERNATIONAL PAPER CO (LIABILITY FOR DESTRUCTION OF GROWING TIMBER BY FLOODING).
179 La 803, 155 So 231-233 (1934).

Descriptors: *Louisiana, *Industrial water, *Prescriptive rights, *Flooding, Acidic water, Mills, Water pollution sources, Waste water (Pollution), Judicial decisions, Legal aspects, Lumber, Discharge (Water), Floods, Streams, Bayous, Swamps, Water rights, Water injury, Flood damage, Relative rights.

Plaintiff owned land which contained standing timber. However, the land was swampy and generally unfit for agriculture. Defendant operated two paper mills which discharged waste water into a creek. The creek entered a bayou which traversed plaintiff's land. Plaintiff's land was bowl shaped and largely flooded during the spring. Plaintiff brought an action for damages to his land and to his timber which he claimed was killed by defendant's waste water. Plaintiff claimed the land was constantly flooded due to defendant's discharges. Defendant contended that plaintiff had notice of timber damage prior to one year before filing suit and that such knowledge precluded recovery, because of prescription, under Louisiana law. The Supreme Court of Louisiana, in affirming the trial court's judgment for defendant, held that plaintiff's cause of action for destruction of growing timber by flooding had been prescribed. The court also held that plaintiff suffered no damage to his land since it was swampy and unfit for agriculture, and the gas prospects which gave the land chief value was not injured. (Powell-Florida)
W71-02567

LAW V GULF STATES STEEL CO (LIABILITY FOR OBSTRUCTION OF NATURAL FLOW OF EXCESS WATER IN STREAM).
156 So 835-841 (Ala 1934).

Descriptors: *Alabama, *Obstruction to flow, *Rainfall, *Impounded waters, Alteration of flow, Natural flow doctrine, Judicial decisions, Legal aspects, Diversion, Dams, Barriers, Reasonable use, Riparian rights, Rain, Floodwater, Floods, Impoundments, Flood damage, Water injury, Excessive precipitation, Damages.

Defendant corporation owned land abutting on a creek and erected a dam across such creek. Defendant, in connection with the dam, constructed a lateral wall on one side of the creek extending from the dam to a bridge located upstream from the dam. Plaintiff, who owned land upstream from the dam, had his crops destroyed by floodwater as a result of heavy rains. Plaintiff brought an action for damages, alleging that the damming and walling of the creek diverted water onto his land. Defendant contended that unusual and excessive rains which constituted an act of God caused the flooding. The Supreme Court of Alabama reversed the trial court's judgment for defendant. The court held that defendant was liable for obstructing the natural flow of excess water in the creek and causing injury to plaintiff's crops. The court stated that unusual and excessive rainfall was not a correct definition of an act of God. The court pointed out, however, that plaintiff would not have been able to recover if his damages would have occurred had the dam not existed. (Powell-Florida)
W71-02568

HILL V LOLLAR (LIABILITY OF SUBSEQUENT PURCHASERS UNDER WATER RIGHTS CONTRACTS).
157 So 870-872 (Ala 1934).

Descriptors: *Alabama, *Remedies, *Relative rights, *Water supply, Adjudication procedure, Land, Land tenure, Contracts, Artesian wells, Pipes, Water sources, Judicial decisions, Legal aspects, Water contracts.

Plaintiff sought to enjoin defendant from interfering with maintenance of a water pipe by which plaintiff obtained his domestic water supply. Defendant's predecessor had contracted with plaintiff for the installation of the pipe which drew water from an artesian well on defendant's land. Defendant, who had acquired his land through a mortgage foreclosure, claimed ownership as a bona fide purchaser without notice of the prior contract and therefore asserted that he was not bound by it. The trial court granted the injunction, but the Supreme Court of Alabama reversed, stating that if the relative positions of the parties in such an action are to be determined, the positions must be alleged in the original bill and answer. That not having been done, the trial court erred in taking testimony on irrelevant issues. The court further held that defendant's predecessors' agreement with plaintiff was ineffectual against a purchaser such as defendant who acquired title at a foreclosure sale. (Barker-Florida)
W71-02569

WESTERN UNION TEL CO V DAMPSKIBS AKTIESELSKABET MAI (LIABILITY FOR DAMAGE TO UNDERWATER CABLE).
176 La 1081, 147 So 354-357 (1933).

Descriptors: *Louisiana, *Navigation, *Communication, *Damages, Mississippi River, Navigable rivers, Anchors, Ships, Boats, Legislation, Permits, Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Relative rights.

Plaintiff telegraph company brought an action against defendant steamship company for the alleged destruction of plaintiff's cable under the Mississippi River. Plaintiff alleged that defendant's ship had dropped its anchor and that the anchor was dragged, causing it to become entangled in and break the cable. Defendant claimed that its anchor had not been dragged to the position of the cable and therefore did not cause the damage. The trial court rendered a verdict for plaintiff. In reversing, the Supreme Court of Louisiana ruled that the evidence was insufficient to support the verdict. The court further ruled that the right to operate the submarine cable was subject to the paramount right of full, free navigation in the river. It was held that even if defendant's acts were the proximate cause of plaintiff's damages, there would be no liability if defendant was following reasonable navigational practices. (Barker-Florida)
W71-02570

CRESSON V LOUISVILLE AND N RR (LIABILITY FOR COLLECTION AND DISCHARGE OF DRAINAGE WATER IN EXCESSIVE VOLUME).
146 So 462-463 (Miss 1933).

escriptors: *Mississippi, *Drainage practices, *lood damage, *Ditches, Railroads, Right-of-way, ainage effects, Drainage systems, Drainage ter, Relative rights, Riparian rights, Drainage, olume, Excavation, Artificial watercourses, Rain-ll, Remedies, Judicial decisions, Adjudication ocedure, Legal aspects, Water injury, Overlying oprietor.

aintiff landowner brought an action against de-ndant railroad to recover for flood damage used by defendant's alleged collection and scharge of excess water onto plaintiff's land. De-ndant had created two excavation pits along its ght-of-way, and drainage from such pits caused a tural drainage ditch across plaintiff's land to erflow following rainfall. The trial court in-ucted the jury to return a verdict for defendant. reversing, the Supreme Court of Mississippi led that the question of whether defendant acted ongfully was determinable by the jury. The court rther ruled that even though an upper owner quires the right of drainage by prescription, such ght does not entitle the upper owner to collect rface waters and discharge them in excess of eir natural volume upon a lower owner's land. arker-Florida)
71-02571

EABOARD ALL FLORIDA RY V UNDERHILL NJUNCTIVE RELIEF FOR FLOODING BY BSTRUCTION OF NATURAL DRAINAGE).
1 So 306-308 (Fla 1932).

escriptors: *Florida, *Embankments, *Obstruc-n to flow, *Flooding, Railroads, Right-of-way, pounded waters, Drainage, Subsurface waters, dicial decisions, Legal aspects, Crops, Drainage actices, Access routes, Diversion, Natural flow, ams, Riddance (Legal aspects), Repulsion (Legal pects), Damages, Surface runoff.

efendant railroad constructed an embankment on right-of-way near plaintiff's land which ob-ucted the natural drainage of water from plain-ff's lands. Such obstruction impounded the sur-ce waters and caused periodic flooding of plain-ff's lands, thereby rendering them useless for their rmal purpose. Plaintiff brought suit to enjoin ch impoundment and obstruction. The Supreme ourt of Florida affirmed the lower court's order verruling defendant's demurrer. A mandatory in-nction was issued against defendant to require it abate the condition which it created by its em-nkment so as to no longer obstruct the flow of rface waters. (Barnett-Florida)
71-02572

OLINGER V MURRAY (LIABILITY FOR EVEE WHICH OBSTRUCTED NATURAL LOW).
7 So 761-764 (La 1931).

escriptors: *Louisiana, *Levee, *Drainage, *Al-ration of flow, Highways, Judicial decisions, atural flow, Impounded waters, Rainfall, Legal spects, Relative rights, Bayous, Drainage prac-ces, Ditches, Flow, Administrative agencies, iversion, Bridges, Administration, Overlying roprietor.

laintiff brought suit to have defendants remove a evee which allegedly caused the flooding of his nds. The levee was constructed by defendants to revent the natural flow of waters from a gravel ublic highway across their lands. Plaintiff alleged hat such levee impeded the natural flow of the ater and caused it to be diverted from its natural ow and impounded on his land following heavy ains. Defendants denied the levee obstructed flow nd contended that a nearby canal, constructed by governmental authority, caused the flooding. In ffirming the lower court's judgment for plaintiff, he court stated that it was proper to improve one's nd but not in such a manner as to cause injury to is neighbor. Water must not be diverted from its atural course and concentrated so as to flow over he adjacent lands of a lower estate where it would not otherwise flow. The court also took notice of the fact that the lower court had found defendants could modify the construction of their levee to prevent such overflow. (Barnett-Florida)
W71-02573

THE M L C NO 10 (STATUTORY REGULATION OF WHARFAGE RATES).
10 F2d 699-705 (2d Cir 1926).

Descriptors: *New York, *Docks, *Rates, *Legislation, Contracts, Beds under water, Bulkhead line, Piers, Claims (Contracts), Judicial decisions, Legal aspects, Admiralty, Ships, Use rates.

Plaintiff wharf owner brought libel to collect wharfage from defendant vessels. Plaintiff's wharves were built upon land under water conveyed to him by the state; the grant implicitly authorized plaintiff to collect wharfage for use by the public. Defendants contended that although the rates plaintiff charged were reasonable, plaintiff could not exact more than the statutory rate fixed by the legislature. Plaintiff asserted that defendants used his wharves knowing his rate, and therefore a binding contract arose by offer and acceptance. The court held that plaintiff was a private wharf owner, and, like all private wharf owners who opened their facilities to the general public, was subject to the wharfage rates established by the legislature. The lower court's decision for plaintiff was reversed. (Hart-Florida)
W71-02574

UNITED STATES V F D GLEASON COAL CO (CRIMINAL PROSECUTION FOR DREDGING NAVIGABLE WATERS WITHOUT APPROVAL).
14 F2d 233-234 (ED Mich 1926).

Descriptors: *Michigan, *Legislation, *United States, *Dredging, Adjudication procedure, Judicial decisions, Legal aspects, Administrative agencies, Federal government, Regulation, Navigation, Alteration of flow.

Plaintiff United States prosecuted defendant coal company for dredging in navigable waters in violation of statute. On motion to quash the indictment, defendant asserted that the statute, which on its face prohibited all dredging without approval of the Secretary of War, only prohibited dredging which would alter the course of the waters. The court observed that Congress clearly intended to prohibit any dredging without approval, and denied defendant's motion. (Hart-Florida)
W71-02575

ANGOLA TRANSFER CO V TEXAS AND P RY (LIABILITY FOR DAMAGES FOR SHIP SUNK BY RAILROAD BRIDGE PROJECTION).
14 F2d 484-488 (ED La 1926).

Descriptors: *Ships, *Piers, *Bridge design, *BRIDGE CONSTRUCTION, Bridges, Administrative agencies, Bulkheads, Piles (Foundations), Railroads, Navigation, Rivers, Damages, Admiralty, Legal aspects, Judicial decisions, Navigable waters.

Plaintiff steamboat owner sued defendant railroad company for damages caused by the sinking of plaintiff's steamboat. Defendant's railroad bridge pier had a steel cap projection extending six inches over the edge of the pier. During a period of high water, this cap was submerged six inches. As plaintiff's vessel passed through the bridge, it struck this projection and sank. Plaintiff asserted that defendant was negligent in maintaining the projection without protection for vessels. Defendant contended that approval of the bridge specifications by the War Department relieved it of liability. Plaintiff pointed out, however, that the plans, which were conditionally approved, included a bulkhead to prevent vessels from striking the pier. This bulkhead was not built. The court observed that vessels have a paramount right to navigate the waterways, concluding that defendant had the burden of providing safe passage for vessels through the bridge. The court determined that an error by the War Department in approving the plans would not relieve defendant from responsibility. Defendant was held negligent in maintaining the projection, and a judgment for plaintiff was entered. (Hart-Florida)
W71-02576

UNITED STATES V PENNSYLVANIA SALT MFG CO (OWNERSHIP OF BED BENEATH DOCK AREA).
16 F2d 476-483 (ED Pa 1926).

Descriptors: *Pennsylvania, *Docks, *Ownership of beds, *Riparian rights, Beds under water, Riparian land, United States, Riparian waters, Navigation, Land tenure, Rates, Low water mark, High water mark, Construction, Bulkheads, Piers, Jetties, Judicial decisions, Legal aspects, Permits, Relative rights.

Plaintiff United States sought an injunction to restrain defendant salt manufacturer from using or charging wharfage for use of a pier. Defendant and plaintiff owned contiguous riparian land. Defendant constructed a pier along the river which extended past the low water mark. Plaintiff constructed a slip along its land, extending it onto defendant's land and into defendant's pier by agreement. Defendant then used the pier and slip, charging wharfage. Plaintiff contended that it owned all the land under the water in the slip, thereby acquiring the exclusive right to use the slip and defendant's wharf. The court found that the dispute involved land both above and below the low water mark. Noting that a riparian owner holds title to land above the low water mark and the state holds title to land below the low water mark, the court observed that the sole right of a non-landowner to land between high and low water marks is for navigation. Such right of navigation is considered a public easement. A riparian owner's construction in navigable waters beyond the low water mark does not thereby give such owner title to the riverbed. A riparian owner may build beyond the low water mark with the state's permission, and such construction is property but not land. Based on these rules, the court held that plaintiff was not entitled to the exclusive right to charge wharfage for use of the pier. (Hart-Florida)
W71-02577

STATE V UNION ELEC LIGHT AND POWER CO (FEDERAL SUPREMACY OVER NAVIGATION AND NAVIGABLE WATERS).
41 F2d 692-699 (CD Mo 1930).

Descriptors: *Missouri, *Dam construction, *Navigation, *Navigable waters, Permits, Dams, Judicial decisions, Legal aspects, Federal government, Federal jurisdiction, State jurisdiction, Eminent domain, Condemnation, Public health, Hydroelectric project licensing, Electric powerplants, Hydroelectric plants, Reservoirs, Submergence, Public lands, Legislation, Administrative agencies, Cities.

Plaintiff state sought to enjoin the construction of a dam by defendant power company. Defendant intended to construct the dam pursuant to authorization by the Federal Water Power Act. Plaintiff contended such construction would: (1) impede navigation; (2) inundate large tracts of public and private land, school districts and highways; (3) create conditions deleterious to public health; and (4) benefit private, not public interests. Defendant contended the dam would aid and benefit navigation. The court stated that Congress has complete jurisdiction over all matters affecting navigation and complete dominion over the navigable waters of the United States under the commerce clause. The court ruled that the dam would aid navigation, that the federal government was supreme in this area, that Congress and not the courts decides on

the necessity for such projects and that the requirements of the Federal Water Power Act had been met. Plaintiff's complaint was dismissed. (Price-Florida)
W71-02578

COHOES POWER AND LIGHT CORP V STATE (CORPORATION'S RIGHT TO CONSTRUCT DAM SUBORDINATE TO STATE'S RIGHT TO IMPROVE NAVIGATION).
128 Misc 130, 217 NYS 839-846 (1926).

Descriptors: *New York, *Reservation doctrine, *Legislation, *Dam construction, State governments, Administration, Judicial decisions, Legal aspects, Water resources development, Dams, Navigable rivers, Navigable waters, Water policy, Prior appropriation, Riparian rights.

Legislation which incorporated plaintiff power corporation and authorized erection of a dam reserved right in defendant state to improve river navigation. Subsequent legislation which authorized plaintiff to erect another dam lacked the river improvement provision. Nineteen years later, defendant state constructed a dam above the dam which plaintiff had erected pursuant to its incorporation act. Defendant also appropriated part of plaintiff's land for canal uses. Plaintiff sought to recover for the value of lands appropriated and for other damages. Plaintiff claimed the destruction of its right to construct another dam pursuant to the second legislation and that the destruction of the right reduced the value of its property. Defendant contended that the reservation in the incorporating act was still in effect and therefore plaintiff had no valid claim except for compensation of lands appropriated. The New York Court of Claims held the legislation authorizing plaintiff to erect another dam was subordinate to defendant's right to improve navigation. The court also stated that failure of plaintiff to construct the authorized dam for nineteen years was sufficient ground for revocation and forfeiture of the right. (Powell-Florida)
W71-02579

EMPIRE STATE RR V STATE (STATE'S RIGHT TO IMPROVE NAVIGABLE STREAM).
133 Misc 6, 231 NYS 36-42 (1928).

Descriptors: *New York, *Navigable rivers, *Water levels, *Flood damage, Damages, Railroads, Navigation, Navigable waters, Dams, Flow, Overflow, Rainfall, Snowmelt, Snow, Precipitation, Administrative agencies, Judicial decisions, Legal aspects, Riparian land, Riparian rights, Channels, Construction, Public benefits, Channel improvement.

Plaintiff railway corporation instituted a claim against the state of New York for money it expended to raise its roadbed along a lake so as to avoid an allegedly higher lake level. Plaintiff alleged that the state had raised the water level of the lake by increasing the height of a dam and retarding the flow of water. The court dismissed the claim. The state has the right to widen, deepen and improve the channel of a navigable stream for the benefit of the public and to facilitate navigation. Riparian ownership is subject to the obligation to suffer the consequences thereof. The state has no liability to injured riparians in the absence of wanton injury, carelessness, negligence or illegality in performance. Defendant's raising of the dam was a part of a general enterprise to improve navigation on the navigable waters in the area. Nothing in the evidence indicated that defendant performed its work negligently or raised the water levels of the lake. The flooding of plaintiff's roadbed was temporary and caused by conditions outside the river channel, namely excess precipitation and accumulated snow. (Duss-Florida)
W71-02580

LITTLE FALLS FIBRE CO V HENRY FORD AND SONS (LIABILITY FOR MAINTAINING FLASHBOARDS FOR PRIVATE BENEFIT ON A FEDERAL DAM).
223 App Div 559, 229 NYS 445-451 (1928).

Descriptors: *New York, *Riparian water loss, *Navigable waters, *Dams, Eminent domain, Canals, Powerplants, Rivers, Water loss, Judicial decisions, Legal aspects, Federal government, Water rights, Water law, Riparian rights, Riparian land, Riparian waters, Public benefits, Competing uses, Relative rights, Remedies.

Plaintiff's manufacturing plants were located on a river branch. Water, impounded by plaintiff's dam across the branch, flowed through a canal to the plants and furnished power. Defendant, licensed by the federal government under the Federal Water Power Act, installed flashboards on a federal dam across the river in connection with its powerplant. Defendant's actions caused a rise in the canal water level and a reduction of plaintiff's water power. Plaintiff brought an action for damages and an injunction. Plaintiff alleged that his property had been taken without just compensation. Defendant claimed that the government authorization was an act in aid of navigation and not subject to judicial review. The court held that plaintiff was entitled to damages and a permanent injunction restraining defendant licensee from maintaining flashboards for private benefit on a federal dam. The court stated, however, that defendant's actions were not a taking of land under navigable waters, to which federal authorities had complete control. The court opined that congressional determination that use is public use is final, but the nature of use, whether public or private, is a judicial question. (Powell-Florida)
W71-02581

VAN CORTLANDT V NEW YORK CENT RR (BRIDGE CONSTRUCTION OVER NAVIGABLE WATERS).
139 Misc 892, 250 NYS 298-315 (1931).

Descriptors: *New York, *Navigation, *Navigable waters, *Bridge construction, Bridges, Railroads, Legislation, Legal aspects, Judicial decisions, Rivers, Dams, Navigable rivers, Non-navigable waters, Public rights, Harbors, Ships, Transportation, Structures, State governments, Adjudication procedure, Bridge design.

Defendant railroad erected a rigid bridge to replace a drawbridge across a river. The river was formerly navigable, but became navigable only by small boats when the state constructed a dam upstream. Plaintiff landowner sought an injunction to force the replacement of the bridge. Plaintiff claimed that the existence of the bridge impeded navigation and decreased the value of his adjacent property. Plaintiff contended that defendant's bridge, which was too low for passage of large vessels, was a public nuisance and violated a statute requiring drawbridges over navigable waters. The court dismissed the complaint. The statute in question required drawbridges only over waters generally navigable in fact. The past existence of commerce on a watercourse does not establish the present navigability in the presence of altered circumstances. The river's navigability by small boats did not establish its navigability for commerce as the term 'navigable waters of the United States' has reference to commerce of a substantial and permanent character. (Dye-Florida)
W71-02582

PEOPLE V BRENNAN (RIGHTS OF PUBLIC IN FORESHORE).
142 Misc 225, 255 NYS 331-336 (1931).

Descriptors: *New York, *Local governments, *High water mark, *Public rights, Low water mark, Recreation, Legal aspects, Judicial decisions, Navigable waters, Fishing, Baits, Water utilization, Sport fishing, Recreation demand.

Appellant fisherman was prosecuted by appellee village for the violation of a village ordinance prohibiting persons from digging bait from the foreshore of the village's beaches without first obtaining a license. Appellant contended that the rights of the public extended to digging bait from the foreshore for use in recreational fishing. Appellee contended that the public's rights were limited to fishing, bathing, and navigation and in no way extended to the digging of bait which had at times resulted in the undermining of the sea walls. The court, in affirming appellant's conviction, held that public rights in the foreshore included only passing, fishing, bathing, hunting and navigation. (Quesada-Florida)
W71-02583

RANSOM V SHAEFFER (TITLE TO LAND BETWEEN HIGH AND LOW WATER MARKS).
153 Misc 199, 274 NYS 570-574 (S Ct 1934).

Descriptors: *New York, *Lakes, *Tidal waters, *Low water mark, High water mark, Tides, Tidal effects, Remedies, Legal aspects, Judicial decisions, Lake Ontario, Lake shores, Water levels, Water level fluctuations, Real property, Contracts, Boundaries (Property).

Plaintiff vendor sought specific performance of a contract for the sale of beach property abutting on a non-tidal lake against defendant vendee. Plaintiff contended that the contract called for the conveyance of his interest in the property and that he conveyed all that he owned. Defendant contended that the contract was void in that he had sought to purchase the land to the low water mark. Defendant contended that plaintiff could only convey to the high water mark because grants of land bounded by tidal waters carry legal title only to the high water mark. Granting an order for specific performance, the court held that Lake Ontario was a non-tidal lake. A grant to land bounded by a non-tidal lake conveys legal title to the low water mark, so plaintiff was able to convey that which he contracted to convey. (Quesada-Florida)
W71-02584

PEOPLE EX REL HUDSON RIVER CONNECTING RR V STATE TAX COMM'N (STATE TAXATION OF BRIDGE OVER NAVIGABLE WATERS).
245 App Div 229, 281 NYS 358-361 (1935).

Descriptors: *New York, *Navigable waters, *Taxes, *Bridges, Ownership of beds, Streambeds, Government supports, Financing, Local governments, State governments, Legal aspects, Judicial decisions, Legislation, Navigation, Non-navigable waters, Assessments, Federal government.

Relator railroad corporation sought to have defendant tax commission's assessment of its bridge reviewed. Relator contended that its bridge was built by authority of Congress and the state was without power to levy a tax upon a franchise from the United States government. Maintaining that the stream which ran under its bridge was non-navigable, relator contended that the bridge was built upon its privately-owned streambed and thus could not be taxed as a special franchise. Defendant contended that Congress' power over navigable waters was limited to matters of navigability and obstruction. Therefore the state could tax such structures because, by granting permission to build the bridge, Congress had waived all prohibitions over the structure. The court held that Congress' power over navigable water was limited to those things necessary to regulate commerce and navigation, and thus the bridge was taxable by the state as a special franchise. The court also found that the stream was navigable, and therefore relator did not own the streambed. (Quesada-Florida)
W71-02585

MASSACHUSETTS V NEW YORK (RESERVATION, IN INTERSTATE TREATY, OF

VEREIGNTY TITLE TO LANDS UNDER VIGABLE WATERS).
1 US 65, 46 S Ct 357-363 (1926).

scriptors: *Lake Ontario, *Accretion (Legal ects), *Ownership of beds, *Boundary disputes, w York, Massachusetts, Lakes, Lake beds, undaries (Property), Treaties, Legislation, State vernments, Land tenure, Legal aspects, Judicial isions, Navigable waters, Lake shores, High ter mark, Low water mark, Prescriptive rights.

intiff Massachusetts sued defendant New York quiet title to land formed by accretions to the reline of Lake Ontario. By the Treaty of Hartd, New York had granted to Massachusetts vate ownership of certain lands bounded by the re of the lake, but had reserved all rights of ereignty and jurisdiction. Massachusetts conded that the grant included the lake bed and, alnatively, that the grant included the shore to the water mark, whereby Massachusetts would be itled to the accretions. New York argued that nership of the beds of navigable waters was a ht of sovereignty and therefore reserved to New rk by the Treaty. New York also argued that ssachusetts owned only to the high water mark d, therefore, was not entitled to the accretion. e United States Supreme Court noted that vereign dominion over navigable waters can only divested by express grant, which did not appear the Treaty, or by prescription, which was cluded by the Treaty and by Massachusetts' acts acquiescence in New York's sovereignty. The urt held that title was in New York. (Liptak-rida)
71-02586

CCORMICK V CHICAGO YACHT CLUB IGHT TO NON-RIPARIAN EASEMENT OF EW ACROSS PUBLIC PARK).
1 Ill 514, 163 NE 418-421 (1928).

scriptors: *Illinois, *Riparian rights, *Easeents, *Parks, Real property, Land tenure, Riparian land, Riparian waters, Lakes, Lake Michigan, ke shores, Right-of-way, Access routes, Docks, ating, Marinas, Recreation facilities, Cities, cal governments, Bulkhead lines, Landfills, ildings, Legal aspects, Judicial decisions, Adjucation procedure, Remedies.
entifiers: Injunction (Prohibitory).

aintiffs owned land abutting the city's waterfront rk. By prior judicial decision, the city held the rk in trust for the public and could not erect any ildings thereon without the consent of the utting landowners. The landowners' rights ounted to easements. The city authorized defennt yacht club to erect a clubhouse and docks on ndfill adjacent to the park. Plaintiffs sued to strain defendant from obstructing their easement view across the park and access to Lake ichigan. Defendant cross-claimed to quiet title to e landfill and to enjoin plaintiffs from bringing y further actions. The court affirmed the dgment dismissing plaintiffs' complaint, holding at plaintiffs were not riparian owners and had no sements of view or access and that defendant's ubhouse did not violate the public trust since it as not on land within the park's original boundaes. However, the court reversed the judgment ieting defendant's title, stating that equity will t act to remove a mere verbal or oral claim ainst property since only written instruments on cord can be considered as clouds on a title. (Lipk-Florida)
71-02587

UPUE ROD AND GUN CLUB V MARLIERE ALIDITY OF TITLE TO LAKE BED OBAINED THROUGH SWAMP LANDS ACT).

32 Ill 322, 163 NE 683-685 (1928).

escriptors: *Illinois, *Lakes, *Swamps, *Ownerip of beds, Beds, Lake beds, Navigable waters, Real property, Land tenure, Recreation, Hunting, Sport fishing, Legal aspects, Judicial decisions, Administrative decisions, Ajudication procedure, United States, State governments, Legislation.
Identifiers: *Swamp Lands Act.

Plaintiff hunting and fishing club sued to enjoin defendants from trespassing on club property to hunt and fish. Plaintiff contended that it had acquired part of the land and the bed of a lake from the state of Illinois, which had allegedly obtained the submerged property from the United States pursuant to the Swamp Lands Act. Defendants contended that plaintiff's title was void since the lake was navigable in fact when Illinois was admitted to the Union. Therefore, title passed to the state at that time rather than by the Swamp Lands Act. The court held that the Secretary of the Interior's listing of the lake as swampland under delegated authority from Congress was conclusive except for a direct attack for fraud or mistake. The listing was not open to collateral attack in this trespass proceeding. The court reversed a judgment dismissing that part of plaintiff's claim applicable to the lake bed. (Liptak-Florida)
W71-02588

IN RE PUBLIC BEACH IN CITY OF NEW YORK (TITLE TO AND CONDEMNATION VALUE OF FORESHORE AND OCEAN BOTTOM).

256 NY 156, 176 NE 5 (1931).

Descriptors: *New York, *Low water mark, *Ownership of beds, *Beaches, Atlantic Ocean, Eminent domain, Condemnation, Condemnation value, Compensation, Legal aspects, Judicial decisions, Oceans, Navigable waters, Boundaries (Property), Tidal waters, Shores, Cities.

The City of New York brought eminent domain proceedings to acquire land for a public beach. The city claimed title to the foreshore, the land between the high and low water marks, through a colonial grant of land bounded by the 'main ocean'. The city also claimed that the property owners were only entitled to nominal damages for a taking of the foreshore and the land below the low water mark. The court held per curiam that the city's grant of land to the 'main ocean' only conveyed title to the high water mark and that the property owners were entitled to recover the full value of the foreshore and the land below the low water mark. (Liptak-Florida)
W71-02589

MAYO V NEW YORK CENT RR (OWNERSHIP OF LAND UNDER BAYS).
263 NY 277, 189 NE 217-219 (1934).

Descriptors: *New York, *Bays, *Ownership of beds, *Boundaries (Property), High water mark, Boundary disputes, Grants, Bodies of water, Land, Real property, Oceans, Rivers, Legal aspects, Judicial decisions, Beds, Beds under water, River beds, Channels, Hudson River, Harbors, Navigable waters.

Plaintiff claimed title to land under water in the Hudson River as successor in title to a colonial patent which included land beneath the surface of coves and bays of the river. Defendant railroad contended that the waters beneath which the land lay were not bays and that plaintiff's property stopped at the high water mark. The Court of Appeals of New York affirmed judgments for plaintiff as to parcels of land found to lie in actual bays or coves. Judgment was reversed as to one parcel lying beneath an alleged bay with headlands more than 5 miles apart. Where a true bay is found, its depth and width are many times greater than the distance between headlands. In the instant case, the court found the body of water to be a bend in the river only, with a distance between headlands so great that the receding shore was washed by the tides without hindrance. There was no true sheltered harbor, and the waters were part of the river. (Dye-Florida)
W71-02590

NIAGARA FALLS POWER CO V WATER POWER AND CONTROL COMM'N (POWER OF STATE TO REGULATE DIVERSION OF NAVIGABLE WATERS).
267 NY 265, 196 NE 51-57 (1935).

Descriptors: *New York, *Diversion, *State jurisdiction, *Federal jurisdiction, State governments, Federal government, Administration, Legal aspects, Electric power, Judicial decisions, Rivers, Navigable waters, United States, Electric power production, Dams, Electric power industry, Public utilities, Running waters, Interstate rivers, Navigation, Navigable rivers, River flow, Treaties.

Plaintiff power company sought to avoid a rental charge by defendant state on water drawn from the Niagara River for use in plaintiff's power plant. A federal treaty allowed diversion of up to 20,000 cubic feet per second. A state law allowed diversion of 15,100 cubic feet per second without charge, with a reasonable rental to be charged for diversions exceeding this amount. Plaintiff contended that the federal treaty was binding on the state and that plaintiff was entitled to divert without charge up to the federal limit. The Court of Appeals of New York reversed an order for plaintiff. The federal government's control over navigable interstate waterways is unquestioned, but is exercised in conjunction with the states. The Niagara River, being navigable in part, is navigable as a whole and is thus under the control of the state within the limits set by Congress. The limit on diversion established by treaty did not affect the right of the state to charge a reasonable rental for diversion. Previous grants by the state to plaintiff were always subject to the state's power to regulate. (Dye-Florida)
W71-02591

CLEVELAND, C C AND ST L RY V MUMFORD (CONSTRUCTION OF LEVEES).
197 NE 826-837 (Ind 1935).

Descriptors: *Indiana, *Flood control, *Levees, *Assessments, Costs, Embankments, Rivers, Navigable waters, Navigable rivers, Railroads, Surface waters, State governments, Federal government, Legal aspects, Judicial decisions, Dikes, Flood protection, Bridges, Structures, Construction costs, Damages, Eminent domain, Benefits, Cost allocation.

Defendant railroads and landowners opposed plaintiff commissioners' petition to construct levees. Defendants contended that: (1) a federal act prohibited obstructions in navigable rivers; (2) defendant railroads were damaged by being forced to reconstruct their tracks to conform to the levees; and (3) defendant railroads should not be assessed for construction of levees which were of no benefit to them. The Supreme Court of Indiana reversed a judgment for plaintiff commissioners, finding that defendants' third ground of argument was valid. The federal act prohibiting obstruction of navigable streams did not extend to structures constructed outside the natural course of a stream but within its limits at its highest overflow. Also, railroads are required, as a condition to their franchise, to alter their facilities to conform to new structures by the state. However, for the purpose of assessment, the cost of such alterations is to be subtracted from any benefits accruing to railroads. The case was reversed for new findings as to benefit and assessment. (Dye-Florida)
W71-02592

POWELL V PORTER (PUBLIC NATURE OF ROAD BUILT ALONG BANK OF A NAVIGABLE RIVER).
172 La 681, 135 So 24-26 (1931).

Descriptors: *Roads, *Banks, *Navigable rivers, *Louisiana, Roadbanks, Rivers, Navigable waters, Riparian land, Judicial decisions, Legislation, Relative rights, Legal aspects, Public lands, Public benefits, Riparian waters, Public rights.

Plaintiffs brought a suit to enjoin defendants from using a road which crossed a corner of plaintiffs' land and led to defendants' land. Plaintiffs contended that the road, which ran along the bank of a river transversing the lands involved, was a private road. Defendants contended that the road was a public one in that the road had been used by the public for over 60 years. The court held that the road was a public road. The court based its decision on a statute which provided that all roads constructed on the borders or banks of navigable rivers were to be deemed public roads. The court held that the road in question, having been constructed by plaintiff riparian proprietors along a navigable river, was a public road, and defendants had a right to use such road. (Snow-Florida)
W71-02593

WILLIAMS V GUTHRIE (STATE OWNERSHIP OF BEDS OFF COASTAL WATERS AS REASON FOR DENYING PRIVATE REPLEVIN ACTION FOR RECOVERY OF A PIER).
137 So 682-686 (Fla 1931).

Descriptors: *Florida, *Ownership of beds, *Coasts, *Piers, Beds, Beds under water, Bays, Littoral, Riparian land, Judicial decisions, Docks, Coastal structures, Relative rights, Legal aspects, Shores, Land tenure, Navigable waters, Remedies.

Plaintiff brought action in ejectment against defendant for recovery of possession of a pier. The pier was constructed upon the submerged lands of a coastal bay. Plaintiff contended that he had been deeded the land adjacent to the submerged land and that his ownership of the coastal land extended into the bay and included the submerged land. Defendant, as heir of plaintiff's grantor, contended that the deed of the upland did not include the submerged land, and thus the ownership of the pier never passed to plaintiff. The court held that the state owned the land submerged under navigable waters. The pier was thus an encroachment upon the property right held by the sovereign. A private party could not by ejectment recover possession of such lands under navigable waters, such lands being owned by the state. Plaintiff's action for ejectment was dismissed. (Snow-Florida)
W71-02594

ROUSE V SAUCIER'S HEIRS (NATURE OF STATE'S OWNERSHIP OF TIDAL MARSHES OF NAVIGABLE RIVERS).
146 So 291-292 (Miss 1933).

Descriptors: *Land tenure, *Tidal marshes, *Mississippi, *Ownership of beds, High water mark, Low water mark, Relative rights, Tides, Marshes, Wetlands, Salt marshes, Tidal waters, Rivers, Navigable rivers, Navigable waters, Judicial decisions, Boundaries (Property), Public rights, Legal aspects, Public benefits, Public lands.

Plaintiff brought an action to cancel claims by defendants to certain tidewater lands. Plaintiff contended that he was the owner of certain tidewater marshes between the high water and low water marks of a navigable river. Plaintiff contended that he had received a grant of land adjacent to the river and that such grant extended to the low water mark. Defendants contended that they had been granted these lands under tidewater by a patent from the state of Mississippi. The court held that the state of Mississippi held lands under tidewater as trustee for the public. Such land is held for public purpose, including commerce and navigation, and the state cannot convey such lands to private owners for private purposes. The court thus held that the state of Mississippi could not have granted the lands in dispute to defendants. The court did not establish what interest plaintiff had in the lands, but held that he had sufficient interest to cancel the claims of defendants. (Snow-Florida)
W71-02595

PERKY PROPERTIES INC V FELTON (PRIVATE RIGHTS IN PUBLIC LANDS).
151 So 892-895 (Fla 1934).

Descriptors: *Florida, *Beds under water, *Ownership of beds, *Aquatic life, Relative rights, Littoral, Legislation, Judicial decisions, Oceans, Shores, Coasts, Gulf of Mexico, Aquatic habitats, Riparian land, Navigable waters, Public rights, Land tenure, Tidal waters.

Plaintiff corporation sought an injunction against defendants to protect its rights to propagate sponges in tidal submerged waters on the Gulf Coast of Florida. Plaintiff contended that the legislature had granted to persons owning certain described lands bordering upon the waters of the state the right to grow and propagate sponges in the waters adjacent to the shoreline. Therefore plaintiff contended that defendants were precluded from disturbing such area. Defendants contended that tidal and submerged lands of the state are held in trust for all the people of the state and therefore defendants had the right to be in such area. The court held that the state could grant private rights in such lands for the use of private individuals to grow and propagate sponges, and reversed the trial court's denial of plaintiff's injunction. (Snow-Florida)
W71-02596

LOUISVILLE AND N RR V O'FLYNN (LIABILITY FOR CROP DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCHES).
213 Ky 346, 281 SW 174-176 (1926).

Descriptors: *Kentucky, *Ditches, *Drainage water, *Water injury, Flooding, Railroads, Embankments, Drains, Culverts, Surface runoff, Flood damage, Crop response, Surface waters, Contracts, Claims (Contracts), Legal aspects, Judicial decisions, Adjudication procedure, Overflow.

Plaintiff farmer brought action against defendant railroad for damages to his land and crops caused by the overflow of drainage ditches along defendant's roadbed. Plaintiff and defendant had settled a prior similar action and, as part of the settlement, defendant agreed to construct and maintain specified drainage ditches. Plaintiff contended that defendant failed to construct and maintain the ditches in accordance with the prior settlement, resulting in the flooding of plaintiff's land and destruction of his crops. Defendant contended that the ditches were built and maintained as specified, that plaintiff was contributorily negligent and that plaintiff could not recover for his crop losses sinch his action sounded in contract, not in tort. Affirming a judgment for plaintiff, the court held that the evidence and the law were properly submitted to the jury. The court also noted that the issues were clearly presented, even though the action was a mixed contract and tort nature, since plaintiff sought only temporary damages to his crops and not permanent damages to his land. (Liptak-Florida)
W71-02597

PENNSYLVANIA RR V ERIE RR (NAVIGABLE WATER WITHIN BULKHEAD LINES).
40 F2d 420-422 (2d Cir 1930).

Descriptors: *New York, *Navigable waters, *Navigation, *Bulkhead line, Bulkheads, Legal aspects, Judicial decisions, Railroads, Fog, Piers, Floats, Damages, Admiralty, Adjudication procedure, Ships.

Libel was brought by plaintiff railroad company against defendant ferryboat and defendant railroad company for damage done to plaintiff's car float by defendant ferryboat. Defendant ferryboat lost its bearing and rammed plaintiff's float during heavy fog. Plaintiff contended that defendant was at sole fault. Defendant contended that plaintiff was also at fault. The court found that plaintiff's float, the last of six moored at the end of a pier, had a duty to make its presence known during fog. The fact that plaintiff was within the bulkhead line was deemed irrelevant as waters within that line are as open to navigation as any others until occupied by piers. The judgment for plaintiff as modified was affirmed. (Price-Florida)
W71-02598

BEST RENTING CO V CITY OF NEW YORK (TITLE TO LAND UNDER WATER).
221 App Div 707, 225 NYS 66-68 (1927).

Descriptors: *New York, *Land tenure, *Grants, *Boundaries (Property), Boundary disputes, Land, Real property, Low water mark, Adjudication procedure, Legislation, Judicial decisions, Legal aspects, Oceans, Navigable waters, Marshes, Tidal marshes, Tidal waters, Beds under water.

Plaintiff company and defendant city both claimed title to a certain tract of upland and accompanying land under water. Plaintiff claimed title under an early grant. Defendant contended that plaintiff's grant did not prove title to the hassock and ground under water which was north of the upland. The Supreme Court of New York affirmed a judgment for plaintiff. Plaintiff made out its case by producing evidence of a prior acquired title. The burden was then on defendant to prove better title, in this case under a legislative act. Plaintiff's grant of title to the upland, bounded by the low water mark, was held to include hassocks and marshes to the low water mark. (Dye-Florida)
W71-02599

SCHIFFERDECKER V BUSCH (TITLE TO LANDS UNDER WATER).
130 Misc 625, 225 NYS 106-112 (1927).

Descriptors: *New York, *Contracts, *Land tenure, *Ownership of beds, Rivers, Land, Real property, Judicial decisions, Legal aspects, Easements, Right-of-way, Water supply, Hudson River, Beds, Beds under water, River beds, Streambeds.

Plaintiff sought to enforce a contract between himself as vendor and defendant as vendee of a piece of property. Defendant contended that plaintiff had not fulfilled his bargain to convey the property unencumbered since there was a water pipe easement across one lot to supply water to the remaining property and that the deed proffered did not convey the land under water adjacent to the property. The Supreme Court of New York held for plaintiff. The water pipe easement no longer existed since plaintiff owned all the property involved and therefore such rights were merged in him. The owner of upland property owns land under water in the Hudson River, thus plaintiff's conveyance of the upland conveyed the adjacent riverbed. (Dye-Florida)
W71-02600

NEW YORK V ILLINOIS (DIVERSION OF WATER FROM INTERNATIONAL WATER COURSES).
274 US 488, 47 S Ct 661 (1927).

Descriptors: *New York, *Illinois, *Lake Michigan, *Diversion, Adjudication procedure, Rivers, Navigable rivers, Riparian rights, International waters, Foreign waters, Lakes, Judicial decisions, Legal aspects, Relative rights, State governments, Water supply, Watercourses (Legal).

Plaintiff New York sought an injunction to restrain defendant Illinois from diverting water from Lake Michigan. Defendant moved to strike a paragraph of the complaint which asserted that the diversion might interfere with plaintiff's use of the Niagara and St. Lawrence rivers for power development. The Court noted that the rivers were international

ereby requiring the consent of Canada and the ited States for diversion of such water. Holding t plaintiff's contention did not assert an actual threatened injury, but only raised an abstract estion, the Court sustained defendant's motion. art-Florida)
71-02601

X RIVER PAPER CO V RAILROAD OMM'N (CONSTITUTIONALITY OF ATUTE REQUIRING DAM OWNERS TO ONSENT TO STATE PURCHASE OF DAM).
4 US 651, 47 S Ct 669-671 (1927).

scriptors: *Wisconsin, *Dams, *Permits, iparian rights, Legislation, Administrative agens, State governments, Administrative decisions, vers, Navigable rivers, Beds under water, Navigan, Ownership of beds, Payment, Compensation, pervisory control (Power), Regulation, Operan and maintenance.

aintiff paper company sought a writ of mandamus compel defendant commission to act upon its apcation to maintain its dam. Plaintiff maintained dam without a permit. State statute required m owners to consent to allow the state to acquire eir dams after 30 years for a preformulated ount as a condition to receiving a permit. Plainf filed for a permit to maintain its dam, but defennt refused to consider the petition for want of judiction since plaintiff had not filed the consent. aintiff asserted that the statute violated the fourenth amendment as a taking without due process. aintiff asserted that under state law the riparian vner held title to the bed of navigable rivers, and erefore it had the right to erect a dam and use ater power. Defendant contended that plaintiff's ght to use water power was subordinate to the ate's control of navigable waters. Finding that aintiff had no property right under state law to e water power, the court held that the statute was nsistent with the fourteenth amendment. The urt stated that while a state may give riparians ghts over navigable rivers, such rights are subject the public rights of navigation, fishing and the tablishment of a public water supply. (Hartorida)
71-02604

ENRY FORD AND SON, INC V LITTLE ALLS FIBRE CO (LIABILITY FOR LOSS OF ATER HEAD CAUSED BY FLASHBOARDS N DOWNSTREAM DAM).
80 US 369, 50 S Ct 140-142 (1930).

escriptors: *Federal Power Act, *Dams, *Hudson iver, *Head loss, River, Navigation, Navigable vers, Legislation, Damages, United States, ederal-state water rights conflicts, Hydroelectric ants, Hydroelectric project licensing, Federal overnment, Judicial decisions, Legal aspects, elative rights.

aintiff riparian owner sought to enjoin defendant deral licensee from placing flashboards on a deral dam which decreased plaintiff's water head. efendant was licensed to use surplus water from e federal dam to generate electricity for private se. The flashboards raised the pool two feet, ecreasing the head of plaintiff's upriver dam comensurately. Defendant asserted that the federal uthority to regulate navigation rendered it imune as a federal agent and that there was no takg of plaintiff's property. Plaintiff asserted that the ashboards were not authorized by the Water ower Act and that their use constituted a fifth mendment taking. Rejecting the contentions of oth parties, the Court observed that the Water ower Act provided that licensees should be liable or damages occasioned by licensed projects, and rohibited interference with state law in water apropriation and control. In affirming, the court eld that these provisions supported the lower ourt's award of damages and an injunction to laintiff. (Hart-Florida)
V71-02612

WISCONSIN V ILLINOIS (INJUNCTION STAYING DIVERSION OF WATER FROM LAKE MICHIGAN).
281 US 179, 50 S Ct 266-268 (1930).

Descriptors: *Illinois, *Lake Michigan, *Sewage, *Diversion, Wisconsin, Missouri, New York, Rivers, Navigable rivers, Navigable waters, Lakes, Riparian rights, Sewage treatment, Water pollution, Alteration of flow, Relative rights, Judicial decisions, Legal aspects, State governments, Water quality.

Plaintiff Wisconsin obtained an injunction against defendant Illinois preventing diversion of water from Lake Michigan for dilution and conveyance of Chicago's sewage. The case was referred to a master to determine the measures and time necessary to effect the decree. In reviewing both parties' exceptions to the master's report, the Court stated that: (1) the rise in Lake Michigan should not have been considered in determining the diversion reduction; (2) the possibility of future congressional action did not affect the prior decree; (3) the Chicago River did not have to be returned to its original direction of flow; and (4) the diverted waters should not be returned to Lake Michigan after purification. Retaining jurisdiction of the dispute, the Court entered a decree in accordance with the master's report, enjoining diversions exceeding stated amounts in such report. (Hart-Florida)
W71-02613

CONNECTICUT V MASSACHUSETTS (STATE'S DIVERSION OF INTERSTATE RIVER FOR MUNICIPAL WATER SUPPLY).
282 US 660, 51 S Ct 286-291 (1931).

Descriptors: *Interstate rivers, *Diversion, *Water utilization, *Reasonable use, State governments, Connecticut, Massachusetts, Natural flow doctrine, Prior appropriation, Relative rights, Riparian rights, Diversion structures, Dams, Reservoirs, Water policy, Water supply, Water rights, Judicial decisions, Legal aspects, Legislation, Domestic water, State jurisdiction, Damages, Water pollution.

Plaintiff Connecticut sued to restrain defendant Massachusetts from diverting water from an interstate river to supply drinking water for the city of Boston. Plaintiff contended that the diversion would interfere with plaintiff's reasonable use, would cause property damage and would interfere with a proposed hydroelectric plant. Plaintiff also contended that the diversion violated the law of riparian use in both states. Defendant contended that the diversion was necessary, reasonable and authorized by the War Department and the Massachusetts legislature. Defendant further argued that the only other source of water for the city was polluted, and its use would be costly and dangerous. The Supreme Court noted that each state has the power to change its law of riparian use and that drinking and other domestic uses of water are of the first importance. The Court held that the advantages resulting from defendant's diversion far outweighed the damages claimed and denied the injunction, but noted that plaintiff could renew its suit should defendant divert more than a reasonable amount of water in the future to plaintiff's substantial damage. (Liptak-Florida)
W71-02614

UNITED STATES V UTAH (STATE VERSUS FEDERAL OWNERSHIP OF BEDS OF NAVIGABLE RIVERS).
283 US 64, 51 S Ct 438-446 (1931).

Descriptors: *United States, *Interstate rivers, *Ownership of beds, *Navigation, Utah, Navigable rivers, Navigable waters, Non-navigable waters, Federal jurisdiction, State jurisdiction, Federal-state water rights conflicts, Colorado River, River beds, Riparian waters, Riparian land, Riparian rights, Legal aspects, Judicial decisions, Boundaries (Property), Public lands, Federal government, Remedies.

Plaintiff United States sued defendant Utah to quiet title to certain river beds in which plaintiff had granted mineral rights to certain parties while defendant had granted those same rights to other parties. Plaintiff contended that the river beds belonged to the federal government since the rivers were non-navigable when Utah was admitted to the Union and introduced evidence showing the paucity of navigation on the rivers at that time and the private rather than public nature of such navigation. Defendant contended that the rivers were navigable at the time of its admission into the Union and that therefore title to the river beds was vested in the state. The Supreme Court noted that the test of navigability was not the extent of actual use of the river for navigation or whether such use was public or private, but the capacity of the river for commercial navigation at that time. The court dismissed plaintiff's petition and held that the rivers in question were navigable in law, if not in fact. (Liptak-Florida)
W71-02616

NEW JERSEY V NEW YORK (INJUNCTION TO PREVENT DIVERSION OF DELAWARE RIVER).
283 US 336, 51 S Ct 478-481 (1931).

Descriptors: *New Jersey, *New York, *Delaware River, *Diversion, Pennsylvania, Alteration of flow, Reasonable use, Navigation, Riparian rights, Navigable waters, Non-navigable waters, Administrative agencies, Administrative decisions, Sewage treatment, Recreation, Fishing, Water pollution, Saline water, Agriculture, Judicial decisions, Legal aspects, Relative rights.

Plaintiff New Jersey sought to enjoin defendant New York from diverting water from the tributaries and watershed of the Delaware River. Plaintiff contended that the diversion would violate the riparian rights of its citizens, asserting impaired navigability, water power, sanitation and recreation. The Court appointed master found that the tributaries affected were non-navigable and that the diversion would not impair the sanitary condition of the river or affect its use for municipal water, industry, agriculture or fishing. However, the master recommended reduction of the diversion to prevent impairment of recreation and recommended installation of a sewage treatment plant. The Court observed that removal of water must be allowed unless substantial harm would result. Although the War Department found no navigational impairment, the court stated that defendant would have to yield to the Department's decision if navigation were later impaired. Affirming the master's report and recommendations, the court limited defendant's diversion to an amount which would not seriously injure plaintiff's rights. (Hart-Florida)
W71-02618

ARIZONA V CALIFORNIA (CONSITUTIONALITY OF BOULDER CANYON PROJECT ACT).
283 US 423, 51 S Ct 522-529 (1931).

Descriptors: *Arizona, *California, *Legislation, *Dam construction, Colorado River, Boulder Canyon Project Act, Prior appropriation, Dams, Colorado River Compact, Interstate compacts, Interstate rivers, Water supply, United States, Competing uses, Project purposes, Water allocation (Policy), Judicial decisions, Legal aspects, Adjudication procedure, Relative rights.

Plaintiff Arizona sought to enjoin defendant California from building a dam on the Colorado River. Plaintiff refused to ratify the Colorado River Compact, approved by Congress in the Boulder Canyon Project Act, which authorized the dam. Plaintiff contended that the Act violated its quasi-sovereign rights. The court noted that Congress could authorize the dam to improve navigation if the river were navigable. Taking judicial notice that the river was navigable, the court held that the Act was not invalid simply because the dam would further purposes other than navigation. Rejecting plaintiff's assertion that the Act prevented plaintiff

from appropriating more water, the court noted that an appropriation is vested, subject only to prior appropriation, and that under Arizona law, a perfected appropriation could only be acquired by physical diversion. The court held that an assumed potential invasion of plaintiff's right to appropriate water was insufficient to declare the Act unconstitutional. Defendant's motion to dismiss was granted. (Hart-Florida)
W71-02619

FLAMBEAU RIVER LUMBER CO V CHIPEWA AND FLAMBEAU IMPROVEMENT CO (DAMS AS OBSTRUCTIONS TO NAVIGATION).
223 NW 417-419 (Wis 1929).

Descriptors: *Wisconsin, *Dams, *Legislation, *Navigation, Lumbering, Access routes, Saw mills, bypasses, Dam construction, Sluices, Administrative agencies, State governments, Navigable rivers, Legal aspects, Judicial decisions, Regulation.

Plaintiff lumber company sought damages and to enjoin defendant dam owner from preventing transport of its logs downriver. Defendant's dams were constructed pursuant to statute, but without the approval of the railroad commission. The statute's purpose was to improve the river's navigability. Plaintiff asserted that the result of the dams was to destroy the navigability of the river. Defendant moved to dismiss the complaint for failure to state a cause of action. From an order sustaining the motion, plaintiff appealed. The court held that the complaint stated a cause of action and that the lower court erred in sustaining the motion to dismiss. (Hart-Florida)
W71-02620

MUNRO V MEILKE (OWNERSHIP OF ISLANDS IN UNMEANDERED NAVIGABLE LAKE).
227 NW 394-396 (Wis 1929).

Descriptors: *Wisconsin, *Land tenure, *Islands, *Ownership of beds, Real property, Legislation, United States, State governments, Reservation doctrine, Lakes, Navigable waters, Navigable rivers, Meanders, Streams, Boundaries (Property), Boundary disputes, Legal aspects, Judicial decisions.

Plaintiff island owner sued to quiet title to islands claimed by defendant, a lessee from the state. The islands were in an unmeandered lake. Plaintiff claimed title through a United States patent which conveyed two 40-acre tracts by governmental description. The islands were located within these tracts. Defendant claimed title through a congressional act which conveyed to the state all unsurveyed islands. Defendant claimed that the islands were part of the navigable lake beds and therefore were state-owned. The court noted that the congressional act passed nothing with respect to the islands since the former patents conveyed whatever title the United States held in them. While agreeing that title to navigable lake beds was in the state, the court noted that the size of islands was immaterial in considering if they were part of the lake bed since islands were not part of the lake bed. The court stated that: (1) a patentee of riparian land takes only to the shore of meandered lakes; (2) all land passes in a patent involving unmeandered lakes; and (3) unmeandered islands within meandered streams pass by patent with adjacent lots when the riparian owner holds title to the thread of the stream. The court affirmed the trial court's ruling that plaintiff owned the islands. (Hart-Florida)
W71-02621

MANNEY V PROUSE (RIGHT OF RIPARIAN OWNERS TO USE OF NON-NAVIGABLE LAKE).
248 Mich 654, 227 NW 685-687 (1929).

Descriptors: *Michigan, *Lakes, *Riparian rights, *Competing uses, Fishing, Boating, Farm ponds, Land use, Reasonable use, Ownership of beds, Relative rights, Remedies, Riparian land, Riparian waters, Usufructuary right, Legal aspects, Judicial decisions, Contracts, Non-navigable waters.

Plaintiff littoral landowner sought an injunction to restrain defendant littoral landowner from trespassing on the lake on which their properties abutted. Plaintiff purchased his tract from defendant, at which time defendant represented that all of the 10-acre, non-navigable lake was within plaintiff's boundaries. In fact, a small portion of the lake was within defendant's boundaries. After the sale, defendant used the lake for eight years before plaintiff brought this suit. Plaintiff asserted that because of the alleged fraud in the sale, defendant should be enjoined from using the lake. The court noted that under state law, defendant had the right to use all the lake providing riparian rights of other owners were not impaired. Rejecting plaintiff's assertion of fraud, the court noted that defendant's ownership of a portion of the lake was obvious to the casual observer, and concluded that actual fraud was highly improbable. Refusing to enjoin defendant from using the lake, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-02622

GRANGER V CITY OF CANANDAIGUA (OWNERSHIP OF LAKE BED ACQUIRED THROUGH INTER-STATE TREATY).
257 NY 126, 177 NE 394-396 (1931).

Descriptors: *New York, *Lake beds, *Ownership of beds, *Boundaries (Property), Massachusetts, Navigable waters, Navigation, Riparian waters, Riparian land, Riparian rights, Land tenure, High water mark, Treaties, Legal aspects, State governments, Cities, Judicial decisions, Landfills, Public lands, Public rights, Boundary disputes.

Plaintiff landowner sued to restrain defendant city from filling in a lake for the purpose of building a park thereon. Plaintiff claimed title to the lake bed through the Treaty of Hartford, by which New York granted certain lands to Massachusetts, which in turn granted the lake bed to plaintiff's predecessor. Defendant contended that the lake was navigable and, therefore, New York retained title to the lake bed, the Treaty only passing riparian title to Massachusetts. The court noted that the question of ownership of beds was unsettled in New York, except on a lake-by-lake basis, and that navigability and size were not the only factors to be considered. Since private ownership had not been asserted for over 100 years and since such ownership would deprive other riparian owners of their riparian rights, the court held that title to the lake bed had remained in the state of New York and affirmed the trial court's judgment dismissing plaintiff's complaint. (Liptak-Florida)
W71-02623

HORNE V HOWE LUMBER CO (EFFECT OF ACCRETION ON PROPERTY BOUNDARIES).
190 SW2d 7-12 (Ark 1945).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Avulsion, *Boundaries (Property), Legal aspects, Judicial decisions, Damages, Remedies, Ownership of beds, Navigable waters, Riparian land, Erosion, Federal government, Local governments, State governments, Surveys, Lumber.
Identifiers: *Geodetic surveys.

Plaintiff filed suit to restrain defendant from cutting timber on part of an island. Defendant and intervenors filed a cross-complaint for damages for timber plaintiff had cut, claiming that title plaintiff had allegedly received in a state tax sale was void because the land had been formed by accretion, not avulsion, and thus was in another county. Defendant won the trial court decision, and plaintiff appealed that defendant by statute could not challenge plaintiff's title unless defendant claimed title himself. The Supreme Court of Arkansas, in affirming the decision for defendant, held the statute applied only to sales by county clerks. The court further held that evidence was sufficient to show that the trial court was not erroneous in holding the land formed by accretion. Land which gradually forms by accretion belongs to the owner of the contiguous land to which it joins. The river remains its natural boundary. In avulsion, the watercourse suddenly changes but the property line remains at the old water line, not subject to the river's caprice. (Morris-Florida)
W71-02625

RANSBERRY V BRODHEAD'S FOREST AND STREAM ASS'N (ENTIRE BED OF STREAM CONVEYED BY DEED).

315 Pa 513, 174 A 97-99 (1934).

Descriptors: *Pennsylvania, *Boundary disputes, *Boundaries (Property), *Ownership of beds, Legal aspects, Judicial decisions, Water rights, Streams, Banks, Fishing, riparian rights, Riparian land, Adjudication procedure, Land tenure, Relative rights.

Plaintiff's predecessor in title conveyed by deed a large tract of land including a stream. There was excepted from the deed a small strip of land bordering the stream on the east. The large tract of land came into the possession of defendant forest and stream association. Plaintiff's deed, in describing the boundary of the small strip of land excepted, listed a stone on the east bank of the stream as the place of beginning and a post on the east bank as the end of the description. Plaintiff brought a quiet title action as to the small strip of land. The dispute depended on whether plaintiff's title to the small strip of land extended to the middle of the stream or ran only along the east bank. The Pennsylvania supreme court held that the description in the deed meant that the east bank of the creek was to be the boundary line. The court affirmed the lower court conclusion that the entire bed of the stream had been conveyed in the deed of the larger tract of land. (Powell-Florida)
W71-02634

WOODY V ABRAMS (BOUNDARY DISPUTE WHERE STREAM SUDDENLY SHIFTS COURSE).
169 SE 915-920 (Va 1933).

Descriptors: *Virginia, *Boundary disputes, *Avulsion, *Accretion (Legal aspects), Bank erosion, Boundaries (Property), Erosion, Streams, Watercourses (Legal), Beds, Channels, Land tenure, Banks, Ditches, Dikes, Diversion, Riparian rights, Judicial decisions, Legal aspects, Riparian land.

Plaintiffs brought statutory proceedings to fix the division line between their lands and the land of defendant adjoining landowner. Plaintiffs' and defendant's lands had originally been divided by a line running with a creek. Plaintiffs contended that there had been a sudden change in the course of the creek and that the boundary line remained the old bed of the creek. The jury returned a verdict for plaintiffs, and the Virginia Supreme Court of Appeals affirmed. Erosive accretions attach to the land on which they fall. In such gradual and natural processes the boundary follows the varying course of the stream. However, if for any natural or artificial cause there is avulsion or sudden change in the bed of the stream, the boundary remains the middle of the old channel. There was no reversible error in the jury verdict for plaintiffs. (Duss-Florida)
W71-02639

PUBLIC PROBLEMS AND NON-DECISION MAKING--A STUDY OF THE TUCSON WATER SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Political Science.
John Adrian Straayer.
Natural Resources Journal, Vol 10, No 3, p 545-556, July 1970.

escriptors: *Water supply, *Water management, ater pollution, Groundwater.
entifiers: *Decision-costs, Water bank, Regu-ed monopoly.

his paper considers the failure of political systems Tucson, Arizona to produce a comprehensive ogram directed toward eliminating the water pply problem. The source of the problem can be und in rapid population growth and diminishing ater sources. Water management in Tucson is ghly decentralized with water available to anyone o sinks a well anywhere in the basin. The lack of ganization of the water system has generated nflict among public and private organizations in-lved in water use. The failure to solve the water oblem is attributed to several factors. First, olitical boundaries do not match problem boundae. Secondly, federal funds have been slow in ming with the result that Tucson has had to oulder the decision-costs alone. Third, a change state legislation is necessary if indiscriminate ater drilling is to cease. The conclusion for Tucn is that the public policy designed to improve e environment tends to be formed only in sponse to known problems as perceived by decin makers who have already invested resources in crisis. (Siegenthaler-Rutgers)
71-02644

ITY OF SCOTTSVILLE V HEWITT (COVE-ANT TO PROVIDE WATER NOT EXTIN-UISHED BY ACT OF GOD).

34 Ky 656, 28 SW2d 984-986 (1930).

escriptors: *Kentucky, *Water sources, *Springs, Supply contracts, Legal aspects, Judicial decions, Damages, Remedies, Cities, Local governents, Municipal water, Water supply, Water conveyance, Water levels, Spring waters, Farms, umping, Water resources, Subsurface waters.

laintiff farmer sued defendant city for breach of a ovenant to supply his farm with water via a water rough from a spring on land which plaintiff sold to efendant. The agreement was part of the conderation for the sale, but defendant argued that he covenant to install a water trough did not mean also had to supply water and, secondly, that an ct of God, which lowered the water supply, extinuished the obligation. Defendant had installed the rough and a replacement, but the water level of he spring decreased enough to make it inoperave. The Court of Appeals of Kentucky, in affirmng a verdict for plaintiff, held the language of the ovenant necessarily implied that defendant would upply water. The court also held that an absolute ndertaking is not discharged by an act of God aking performance more difficult. Plaintiff was warded damages and an injunction requiring deendant to provide water. (Morris-Florida)
V71-02659

GOVERNMENTAL COOPERATION IN RECREATION AND FLOOD PLAIN DEVELOP-MENT,
Virginia Outdoor Recreation Commission.
For primary bibliographic entry see Field 06F.
W71-02662

UNITED STATES V DOUGHTON (MEANING OF NAVIGABLE WATERWAYS UNDER THE COMMERCE CLAUSE).

52 F2d 936-940 (4th Cir 1933).

Descriptors: *Navigable waters, *Non-navigable waters, *Federal jurisdiction, *Inland waterways, Navigation, Streams, Federal government, Legal aspects, United States, North Carolina, State jurisdiction, Judicial decisions, Boats, Transportation, Lumbering, Bridges, Engineering structures.

Plaintiff federal government sought to enjoin the highway commission of North Carolina from maintaining a bridge across a creek. The creek had been dredged and made a part of an inland waterway constructed by plaintiff. Plaintiff contended that the creek was a navigable stream subject to the plenary federal power over navigation under the commerce clause. Plaintiff contended that the bridge was an obstruction to the new waterway. Defendant contended that the stream was not a navigable waterway within the purview of the commerce clause. The Circuit Court of Appeals, Fourth Circuit held that for a stream to be within the regulatory power of Congress as navigable water of the United States, it must be susceptible in its natural condition of becoming a highway of commerce. The mere fact that the stream had occasionally been used by small boats and for floatage of logs did not establish a susceptibility of becoming a highway of commerce, especially in light of the smallness of the creek. The creek was non-navigable and not subject to federal regulation. The injunction was denied. (Snow-Florida)
W71-02668

NEW LOOK IN CONSERVATION BRINGS NEW HOPE FOR ENVIRONMENTAL QUALITY,
For primary bibliographic entry see Field 06G.
W71-02669

CLARK V PIGEON IMPROVEMENT SLIDE AND BOOM CO (FREE AND OPEN COMMERCE OF CANADA-UNITED STATES BOUNDARY STREAMS REQUIRED BY TREATY).
52 F2d 551-557 (8th Cir 1931).

Descriptors: *Treaties, *Streams, *Minnesota, *Lumbering, Obstruction to flow, Foreign trade, Foreign waters, Stream flow, Judicial decisions, United States, Barriers, Floating, International law, International waters, Interstate rivers, Relative rights.

Plaintiff, a Canadian citizen, brought an action for an injunction to stop defendant from obstructing the floatage of logs down a stream. Plaintiff contended that the stream, being a boundary stream between Canada and the United States pursuant to the Webster-Ashburton Treaty, was to be open and free for trade and travel under the terms of the treaty. Defendant, a corporation authorzed by Minnesota legislation to tax floatage of logs upon the stream, contended that its obstruction to the stream was a permissible means of collecting its tolls. The court held that the treaty establishing the Canadian border was superior to Minnesota legislation, and thus the provision in the treaty establishing border streams as free and open to commerce was to govern. Defendant was thus enjoined from imposing any tax upon the floatage of logs and was enjoined from further hindering the floatage of logs down the stream. (Snow-Florida)
W71-02675

PEARCE V SCOTT (OBSTRUCTION OF NATURAL FLOW OF DRAINAGE FROM DOMINANT LAND).
29 F2d 630-631 (DC Cir 1928).

Descriptors: *District of Columbia, *Obstruction to flow, *Natural flow doctrine, *Repulsion (Legal aspects), Relative rights, Barriers, Legal aspects, Remedies, Damages, Judicial decisions, Surface waters, Riddance (Legal aspects), Drainage water, Snowmelt, Surface drainage, Runoff, Rain water.

Plaintiff upper landowner sought to enjoin defendant lower landowner from maintaining a road which ran along the boundary of the two adjoining tracts of land. The road obstructed the natural flow of surface water from plaintiff's land and caused the waters to collect on his land. Plaintiff contended that an upper landowner had a right to the unobstructed flow of surface water from his land. Defendant contended that a lower landowner could lawfully obstruct the natural flow of surface water from higher property. The United States Court of Appeals for the District of Columbia held that the common law rule, which grants the right to obstruct surface waters to lower landowners, applied. Therefore, the injunction against defendant would not issue. (Quesada-Florida)
W71-02684

CANE CREEK COAL MINING CO V BRADEN (DAMAGES CAUSED BY COAL COMPANY'S IMPEDING FLOW OF STREAM).
144 So 143-145 (Ct App Ala 1932).

Descriptors: *Alabama, *Obstruction to flow, *Floods, *Coal mine wastes, Overflow, Water pollution, Damages, Flow, Streams, Rainfall, Flood damage, Watercourses (Legal), Wastes, Industrial wastes, Water pollution sources, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff landowner brought suit to recover damages from defendant coal company. Plaintiff alleged that defendant had clogged a stream with debris, thereby obstructing the flow so that during heavy rainfall the stream overflowed plaintiff's land and damaged his crops. Defendant contended that another coal company had washed debris into the stream and that there was concurrent liability for plaintiff's damage. Therefore, plaintiff had the burden of proving what portion of the damage was allocable to each operation. The Court of Appeals of Alabama, affirming a lower court verdict for plaintiff, held that there was sufficient evidence of concert of action, and it was for the jury to fix the damage done by defendant. Also, the trial court properly refused instruct the jury that heavy rainfall was a basis for ignoring defendant's clogging of the stream. Finally, non-expert witnesses were qualified to testify as to the clogged condition of the stream. (Duss-Florida)
W71-02686

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, ROCKY AND WOLF CREEKS, MACON AND BIBB COUNTY, GEORGIA.
Corps of Engineers, Savannah, Ga.
For primary bibliographic entry see Field 04A.
W71-02214

FLOOD PLAIN INFORMATION, CITY OF ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA, FOURMILE RUN.
Corps of Engineers, Baltimore, Maryland.
For primary bibliographic entry see Field 04A.
W71-02285

THE EFFECTIVENESS OF FLOOD CONTROL STRUCTURES OF THE LOWER MINNESOTA RIVER WATERSHED DISTRICT.
Lower Minnesota River Watershed District, Burnsville.
For primary bibliographic entry see Field 04A.
W71-02312

FLOOD PLAIN INFORMATION, FLOOD HAZARD REPORT OF 4-7 JULY 1969 FLOOD, BLACK RIVER, OHIO.
Corps of Engineers, Buffalo, N.Y.
For primary bibliographic entry see Field 04A.
W71-02447

FLOOD PLAIN INFORMATION, DESTIN COASTAL AREA, OKALOOSA COUNTY, FLORIDA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-02453

FLOOD PLAIN INFORMATION, YAKIMA-UNION GAP, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W71-02456

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, SEMINOLE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W71-02457

REGIONAL PLANNING AND FLOOD PLAIN MANAGEMENT,
Pennsylvania State Planning Board, Harrisburg.
For primary bibliographic entry see Field 06B.
W71-02640

A RECURSIVE PROGRAMING FOR NON-STRUCTURAL FLOOD DAMAGE CONTROL,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 06A.
W71-02646

OPPORTUNITIES AND RESPONSIBILITIES OF LOCAL GOVERNMENT,
Urban Renewal Board, Waterloo, Iowa.
George W. Griebenow.
In: Flood Damage Abatement--Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 1-17, July 1970.

Descriptors: *Flood control, Flood damage, Urban renewal, Urbanization.
Identifiers: *Flood plain management, *Flood plain information, Metropolitan areas.

The city of Waterloo, Iowa suffered severe flooding in the 1960's because of its location at the confluence of 5 rivers. The great damage stimulated civil leaders to seek flood control planning by initiating a program with the Department of Housing and Urban Development. Flood control programs included raising bridges, river dredging and land fill, constructing an industrial part, purchasing land, and securing cooperation from various civil groups. Parks were recommended for low areas because flood damage would be inexpensive. Close work with the Army Corps of Engineers was vital to flood control planning. (See also W71-00002) (Wray-Chicago)
W71-02650

LAND USE MANAGEMENT AN ECONOMIC NECESSITY,
Kentucky Univ., Lexington.
L. Douglas James.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 18-32, July 1970. 1 ref.

Descriptors: *Flood control, Water management.
Identifiers: *Flood plain management.

Land use management should emphasize the best rather than the least use of flood plains. Excessive restriction of flood plain development can hamper the long-term economic growth of any community. Excessive development can lead to a flood damage epidemic. Structural measures are engineering works used to control flood damages on the community level. Nonstructural measures are employed by individuals to reduce damage to their own property. Flood control alternatives must be considered for engineering feasibility, economic feasibility, financial feasibility, social feasibility, and political feasibility. It is unwise for a community to manage flood plain land use by relying entirely on individuals planning the use of their own land to meet their own best needs. The most effective management program is the one where the community uses the management decisions of the property owners to the fullest extent. New federal policy seeks to motivate communities to require individuals to employ nonstructural measures by making free structural measures contingent on an active nonstructural program. The flood proofing decision must consider the range of available methods and the cost and reduction in average annual damages associated with each one. An active and informed land use management program can make a major contribution toward the economic growth of communities containing substantial areas in flood plains. (See also W71-00002) (Wray-Chicago)
W71-02651

FLOOD PLAIN INFORMATION REPORTS,
Corps of Engineers, Washington, D.C.
George R. Phippen.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 33-38, July 1970.

Descriptors: *Flood control, Planning, Federal government.
Identifiers: *Flood plain management, *Flood plain information.

The Army Corps of Engineers' Flood Plain Management Services Program provides the basic flood information, interpretations, technical services, and guidance, with encouragement to the non-federal section which will enable it to plan for appropriate use of flood plains. The Federal Plain Information Report gives information on floods and flood areas, including graphical presentations and photographs. Two types of flood probability are called the Intermediate Regional Flood and the Standard Project Flood. The information in the report is used to identify the flood plain and to show the depths of flooding which may occur. This is helpful in forming zoning restrictions, subdivision regulations, and building codes. (See also W71-00002) (Wray-Chicago)
W71-02652

ENGINEERING DATA FOR SOUND LAND USE PLANNING,
Corps of Engineers, Washington, D.C.
John R. Philpott.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 39-44, July 1970.

Descriptors: *Flood control, Future planning.
Identifiers: *Flood plain information, *Flood plain management.

The purpose of the flood plain information report is to provide specific and detailed knowledge of the flood situation at desired locations. It is possible to determine to a reasonable degree of accuracy, the average return interval of a particular flood height or flow rate at various locations for floods up to the size of about the 100-year flood. After the average flood expectancy is figured, decisions must be made on the use of the flood plains. The Corps of Engineers and the Weather Bureau cooperate in estimating the flood potential of streams. They can also determine the waterway area available at any elevation, or in the case of a known flood height and rate of flow, they can measure the depth of flow by inspection, and compute the velocity of the flow. The conventional approach to flood problems is constructing dams or levees; these structures often do not prevent all flooding, especially in downstream areas. Developers are often lured to downstream areas believing them to be flood-safe. The data available for preventing developments in hazardous areas is available through the Corps of Engineers, TVA, U.S. Geological Survey, U.S. Weather Bureau and other organizations. (See also W71-00002) (Wray-Chicago)
W71-02653

FLOOD PLAIN INFORMATION STUDIES APPLIED TO LOCAL CONDITIONS,
Henrico County, Va.
William W. Fleming.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 45-52, July 1970.

Descriptors: *Flood control, Future planning.
Identifiers: *Flood plain information, *Flood plain management.

Effective flood plain planning usually requires flood plain zoning, technical personnel to establish design standards and criteria, and a working relationship with the U.S. Army Corps of Engineers. A serious problem in developing design standards and flood control is delineating the flood plain contours on major watersheds. When the probable flood lines are established by the Corps, zoning must be comprehensive. In any rapidly expanding urban area, drainage problems, unless properly controlled, will increase proportionally to the density of development. Zoning must be enforced to prevent developments in flood prone areas. (See also W71-00002) (Wray-Chicago)
W71-02654

OPEN SPACE PROGRAM, LAND USE MANAGEMENT,
Department of Housing and Urban Development, Washington, D.C.
Stanley Glowacki.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 53-64, July 1970.

Descriptors: Urban renewal, Community development.
Identifiers: *Open space, Metropolitan areas.

The Department of Housing and Urban Development provides a 50% grant program to metropolitan regions seeking to develop open space areas in flood control management. The current effort is to turn the program toward the intercity, and low-income areas. Although 50% grants are offered for land acquisition only 12 1/2% of the acquisition cost is allowed for development (except in low income areas). The intent of HUD is to put the money where the people are, where the great masses of people can enjoy open spaces created with HUD money. Land that is acquired by a community with HUD aid must remain in open use forever. The only way such land is taken out of open space use is through release by HUD and replacement with land of equal fair market value elsewhere within the community. Applicants for HUD funds wait less than six months to know if they will receive assistance. Two independent appraisals are required for each application. (See also W71-00002) (Wray-Chicago)
W71-02655

OPEN SPACE PROGRAM OPPORTUNITY IN LAND MANAGEMENT,
National Capital Park and Planning Commission, Washington, D.C.
Frank Rubini.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 65-67, July 1970.

Descriptors: *Flood control, Conservation.
Identifiers: *Flood plain information, *Flood plain management, Open space.

Large population growth and ensuing land developments in narrow stream valleys contribute to high velocity runoff and unmanageable accumulations of storm waters. Water retention structures and land treatment measures are methods of dealing with this problem. In Maryland and Washington, D.C. recreation development is restricted to no more than one-third of a given land parcel, with the

balance for passive or conservation use. Largely grassed or wooded, these areas serve as effective aquifer sponges, and contribute to the reduction of runoff velocity. (See also W71-00002) (Wray-Chicago)
W71-02656

COMPREHENSIVE FLOOD PLAIN DEVELOPMENT WITH TVA,
Tennessee Valley Authority, Knoxville.
John W. Weathers.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 68-71, July 1970.

Descriptors: *Flood control.
Identifiers: *Flood plain information, *Flood plain management.

The Tennessee Valley Authority initiated its flood plain management assistance (local flood relations) program in 1953 with a fixed formula for solving flood problems. TVA would supply basic flood data to a community which would then exercise its police power through zoning ordinances, subdivision regulations, and building codes to control uses of flood hazard areas. The data is supplied only when requested by the local community and sent to the designated state agency for endorsement. The community must show its intent to use the information and the state agency must pledge its assistance. Wide distribution of the report and counseling with prospective developers of flood plain lands often result in adjustments to the flood problem. Local planning commissions proceed with flood plain regulations when the data is documented. TVA and state personnel assist the planning commission in presenting the recommendations to the governing body. TVA also responds to requests for appraisals of flood problems associated with industries, subdivisions, utilities, roads and streets. (See also W71-00002) (Wray-Chicago)
W71-02657

A CASE IN POINT,
Coeburn, Va.
W. C. Lambert.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 72-74, July 1970.

Descriptors: *Flood control, Community development.
Identifiers: *Flood plain management, *Flood plain information.

After the town of Coeburn, Virginia suffered severe flooding in 1963, the town council appointed a flood study commission to cooperate with TVA in the development of a comprehensive flood damage prevention plan. A feasibility study and subcommittees were set up. The resulting flood control project also stimulated industrial development and beautification project. Suggested improvements for TVA's program include having property appraisals done by federal and local agencies and acquiring more adjacent land for recreational uses. (See also W71-00002) (Wray-Chicago)
W71-02658

FAIRFAX COUNTY COOPERATES,
Fairfax County, Va.
Carl W. Porter.
In: Flood Damage Abatement, Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, p 87-94, July 1970. 1 map.

Descriptors: *Flood control, Management, Planning.
Identifiers: *Flood plain management, *Flood plain information.

In the rapidly expanding urban area of Fairfax County, Virginia, the natural forest cover was removed and serious flooding occured more frequently. Private studies analyzed the flood hydrology of the streams, established the flood plain levels, and included master plans for improvements to protect those areas already developed and exposed to worsening periodic flooding. When the plans were completed and the referendum held, the citizens voted it down. The County then entered into a pilot study project with the U.S. Geological Survey. Both the county and the Geological Survey were enthusiastically hopeful that it would enable such a fast developing urbanizing area to plan ahead. An order of priorities was established secheduled to give first priorities where most of the new development was taking place. Because of skyrocketing land values, the county employed private surveyors to establish monumental base lines to good second-order survey accuracy in addition to the Geological Survey maps. Sections of the building code and zoning restrictions are listed. (See also W71-00002) (Wray-Chicago)
W71-02660

FLOOD PLAIN MANAGEMENT IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison. Flood Plain and Shoreland Management Section.
Thomas M. Lee.
In: Flood Damage Abatement--Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, July 1970, p 95-108. 2 fig.

Descriptors: *Flood control, Management, Planning.
Identifiers: *Flood plain management, *Flood plain information, Comprehensive planning.

In 1966 Wisconsin legislature provided for joint local-state action for flood damage abatement. Local units of government are required to enact, administer and enforce reasonable and effective flood plain zoning ordinances. State responsibilities include establishing and upgrading minimum standards for flood plain regulations, surveillance, and coordinating flood plain management with programs of other federal, state, local and private organizations. Flood plain management standards reflect the necessity of providing for the needs of nature and man. First the stream channel and floodway are retained, usually to be used for agriculture, recreation, or parking. Next, flood protection is provided for areas outside the floodway but still subject to inundation by flood waters. When community development plans provide for significant use of the flood plain, it is necessary to determine the changer in flood heights which will be caused by future developments. State standards govern these developments. The Corps of Engineers flood plain management services program has been most effective in assisting communities in flood plain delineation. One of the most important aspects in tailoring flood plain regulations to local needs is the selection or determination of the floodway. Ten hydraulic factors that influence the selection of the floodway are listed. Success of Wisconsins flood plain management program depends on thorough public understanding, local support, and enforcement of land use regulations. (See also W71-00002) (Wray-Chicago)
W71-02661

GOVERNMENTAL COOPERATION IN RECREATION AND FLOOD PLAIN DEVELOPMENT,
Virginia Outdoor Recreation Commission.
Elbert Cox.
In: Flood Damage Abatement--Federal Assistance to Local Government, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, July 1970, p 109-114.

Descriptors: Flood control.
Identifiers: *Flood plain management, *Flood plain information.

The Commission of Outdoor Recreation was conceived to further cooperation and coordination of programs in recreation by different levels of government. Funds are divided between federal government and states on a 60/40 basis. Flood Plains often provide choice sites for park and recreation facilities. The Flood Plain Zoning Act amendment authorizes counties or municipalities to impose zoning on flood plains to give them protection. The Commission will make studies of individual rivers, prepare reports to the General Assembly with specific recommendations for the creation of a scenic river. The development of recreational areas and scenic rivers can contribute materially to flood damage abatement. (See also W71-00002) (Wray-Chicago)
W71-02662

SCS PROGRAMS IN URBAN AND RURAL DEVELOPMENT,
Soil Conservation Service, Beltsville, Md.
John K. Abernathy.
In: Flood Damage Abatement--Federal Assistance to Local Government, Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, July 1970, p 115-121.

Descriptors: *Flood control, *Conservation, Water policy.
Identifiers: *Flood plain management, *Flood plain information, Metropolitan areas, Water resources planning.

The services of the Soil Conservation Service are available in helping solve urban and suburban as well as rural conservation problems. The urban expansion has brought conservation problems to nonfarm lands. The SCS of Virginia had programs involving (a) soil surveys, (b) assistance through conservation districts, (c) assistance to non-farm and urban groups, (d) resource conservation and development projects, (e) preparation of natural resource data, (f) water-resource activities and river-basin investigations, and (g) small watersheds. (See also W71-00002) (Wray-Chicago)
W71-02663

6G. Ecologic Impact of Water Development

NATIONAL ESTUARY STUDY --- VOLUME 1. MAIN REPORT.
Fish and Wildlife Service, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02217

NEW LOOK IN CONSERVATION BRINGS NEW HOPE FOR ENVIRONMENTAL QUALITY,
Sydney Howe.
In: Water Spectrum, Vol 2, No 3, Fall 1970, p 2-5.

Descriptors: *Conservation, *Resource development, *Environment, *Political aspects, *Organizations, Federal government, Planning.
Identifiers: *National Environmental Policy Act of 1969, *Council on Environmental Quality, *Confrontation, *San Francisco Bay Conservation and Development Commission, *Conservation Foundation, Corps of Engineers.

In recent years the narrower ethic of the conservation movement which emphasized rural or wilderness preservation has been broadened to encompass the whole environment of man. Rampant technology has with all its blessings, brought unwanted by-products and multiplied the pressures upon basic natural resources, making their conservation more complex. New organizations and new coalitions are adding to the political pressure where decisions regarding environmental quality standards are made. The author reviews coalitions that have formed recently; the expanded 1970 appropriations by congress is traced back to this in-

creased activity. It is contended that there is strength in the diversity of organizations. Governments at all levels are beginning to reflect public impatience with environmental insults. The National Environmental Policy Act of 1969 establishes the Council on Environmental Quality to advise the President and to direct all Federal agencies in recommending legislation. It is suggested that 'healthy confrontation' based on tolerance, education, and give-and-take with unbiased and complete public information will insure effective problem solving. The San Francisco Bay Conservation and Development Commission is cited as an example of such convergence as are efforts by the Conservation Foundation in a number of areas conflicts. Stressed is the need for stricter, more comprehensive analysis of alternatives with conservationists and developers cooperating in finding solutions.
W71-02669

07. RESOURCES DATA

7A. Network Design

WATER RESOURCES DATA FOR COLORADO-1968: PART 2. WATER QUALITY RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02470

7B. Data Acquisition

SEDIMENT MEASUREMENT TECHNIQUES: RESERVOIR DEPOSITS,
For primary bibliographic entry see Field 02J.
W71-02205

ABOVE-BOTTOM ACOUSTIC REFLECTIONS, MISSISSIPPI RIVER DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W71-02211

A CONTRIBUTION TO THE SOLUTION OF GROUNDWATER FLOW PROBLEMS BY MEANS OF PASSIVE ELECTRICAL ANALOGUE MODELS BY DISCRETIZATION OF THE TIME VARIABLE,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 02F.
W71-02261

THE ROCK AND BONG TECHNIQUES OF MEASURING WATER LEVELS IN WELLS,
Missouri Univ., Rolla. Dept. of Geology and Geophysics.
David M. Stewart.
Groundwater, Vol 8, No 6, p 14-18, November-December 1970. 5 p, 1 fig, 2 tab.

Descriptors: *Water levels, *Water wells, *Sounding, *Depth, Measurement, Water measurement, Instrumentation, Surveys, Velocity, Sound waves, Calibrations.
Identifiers: Well water levels, Fall time, Reverberation.

The depth to water in wells can be measured by timing the fall of a marble or BB. Depth to water can also be determined in terms of the frequency of the reverberations heard in a well. Because of their inherent inaccuracies these methods cannot replace the standard methods such as the steel tape or electric sounder. But both have a wide range of useful applications. Considerable time could be saved if an estimate were known before applying a steel tape or electric sounder. The reverberation technique has the distinct advantage of applicability to wells that have no access. The fall technique can be used when falling water makes a steel tape useless and an electric sounder is not available. (Knapp-USGS)
W71-02445

DISTRIBUTION OF PLANKTON IN RELATION TO THE LAYER OF REDUCED TRANSPARENCY (IN RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
E. A. Lubny-Gertsyk, and V. I. Degtyarev.
Doklady Akademii nauk SSSR, Vol 176, No 2, p 443-445, 1967. 1 fig, 6 ref.

Descriptors: *Sampling, *Pacific Ocean, *Plankton, Analysis, Photosynthesis, Distribution patterns, Photometry, Tropical regions, Nets.
Identifiers: *Transparency, Vertical distribution, Coordinated sampling method.

The relationship between the transparency of water and the vertical distribution of plankton was investigated during the expedition of the ship 'Vityaz' to the tropical zone of the Pacific Ocean. The position of the reduced transparency layer was determined by a light meter of the FPM-60 type. The simultaneous 'coordinating sampling' of plankton in the layer of reduced transparency was done by nets, ocean model DZhOM-80/113. Despite of inaccuracies of analyses, inflicted by ship movement, a general relationship between the plankton density and the position of the reduced transparency layer was observed. The minimum transparency and the maximum density of plankton were confined to an approximate depth of 20 meters. The introduced method of 'coordinated sampling' promises to explain the peculiarities in plankton distribution and the nature of the reduced transparency layers. (Wilde-Wisconsin)
W71-02521

CALCULATION OF PRECIPITABLE WATER,
Weather Bureau, Silver Spring, Md. Techniques Development Lab.
For primary bibliographic entry see Field 02B.
W71-02608

THE REMOTE SENSING OF OIL SLICKS BY RADAR,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 05A.
W71-02615

A RAPID, NONDESTRUCTIVE TECHNIQUE FOR INFRARED IDENTIFICATION OF CRUDE OILS BY INTERNAL REFLECTION SPECTROMETRY,
For primary bibliographic entry see Field 05A.
W71-02673

FAST-RESPONSE OXYGEN SENSOR TESTED.
For primary bibliographic entry see Field 05A.
W71-02676

MEASUREMENT AND SIGNIFICANCE OF ADENOSINE TRIPHOSPHATE IN ACTIVATED SLUDGE,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05A.
W71-02677

A HAND-OPERATED WINCH FOR BACTERIOLOGICAL WATER SAMPLING,
Hawaii Univ., Honolulu. Dept. of Microbiology.
K. R. Gundersen, R. Ohye, and D. Stroupe.
Journal (of the) Water Pollution Control Federation, Vol 42, No 1, p 131-132, January 1970. 2 fig.

Descriptors: *Sampling, *Mechanical equipment, Water analysis.
Identifiers: *Winch.

A hand-operated winch is described and illustrated. The features of the winch are: (1) simultaneous sampling of several 250-ml water samples at different depths from surface to approximately 150 m can be made, (2) it is attachable to the railing of a small boat, (3) it is easily portable by one man, (4) it is noncorrodible by sea water, and (5) it is inexpensive. (Little-Battelle)
W71-02679

7C. Evaluation, Processing and Publication

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02202

IMPLICIT FLOOD ROUTING IN NATURAL CHANNELS,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02E.
W71-02207

A COMPUTER PROGRAM FOR THE CALCULATION OF HYDROMETER SIZE ANALYSIS,
University Coll. of North Wales, Bangor. Dept. of Physical Oceanography.
S. Buchan, A. Jones, and P. Simpkin.
Marine Geology, Vol 9, No 4, p M23-M29, November 1970. 7 p, 4 fig, 3 ref.

Descriptors: *Computer programs, *Particle size, *Hydrometers, *Stokes law, *Settling velocity, Suspension, Hydrometry, Suspended load, Sedimentation, Sedimentology, Instrumentation, Sediments.
Identifiers: *Particle size analysis, Algol computer programs.

An ALGOL computer program is presented for the calculation of the results from the hydrometer method of particle size analysis. The program was written to obtain particle diameter, in millimeters and in phi units, the cumulative weight percent finer than the corresponding equivalent particle diameter, and the normalized cumulative weight percent. Stokes' equation is solved using data from a standard hydrometer analysis. The parameters measured are: temperature of the suspension, the corrected hydrometer reading, the elapsed time from the start of the analysis, total oven dry weight of sample, the specific gravity of the solids, the dispersing agent correction, and weight of sediment retained on standard B.S. sieves. (Knapp-USGS)
W71-02215

WATER RESOURCES DATA FOR COLORADO 1969: PART 1. SURFACE WATER RECORDS.
Geological Survey, Denver, Colo. Water Resources Div.

Copies of report available from District Chief, Water Resources Div., US Geological Survey, Denver Federal Center, Denver, Colo, 80225. Geological Survey Duplicated Basic Data Report, 1970. 394 p, 3 ref.

Descriptors: *Surface waters, *Streamflow, *Flow measurement, *Data collections, *Hydrologic data, Gaging station, *Colorado, Flow rates, Average flow, Low flow, Lakes, Reservoir stages.

Identifiers: *Basic data, Stream discharge, Flow extremes.

Surface-water records for the 1969 water year (October 1, 1968 to September 30, 1969) for Colorado, including records of streamflow or reservoir storage at gaging stations, partial-record stations, and miscellaneous sites, are given. Records for a few pertinent gaging stations in bordering States also are included. These data represent that portion of the National Water Data System collected by the U. S. Geological Survey and cooperating State and Federal agencies in Colorado. (Woodard-USGS)
W71-02246

HYDROGEOLOGIC DATA FOR THE SOUTHWESTERN COASTAL RIVER BASINS, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02E.
W71-02259

CONTROL OF SEA WATER LEVEL IN COASTAL POROUS MEDIA BY MEANS OF DOUBLE PUMPING,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-02265

WATER MOTION IN EARTH STRUCTURES AT VARYING WATER LEVELS IN A REACH,
Akademiya Nauk SSSR, Novosibirsk.
For primary bibliographic entry see Field 02G.
W71-02269

DIRECTORY OF FEDERALLY SUPPORTED INFORMATION ANALYSIS CENTERS.
Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information.
For primary bibliographic entry see Field 10.
W71-02310

FOUR-POINT METHOD OF CHARACTERISTICS,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-02431

PUBLIC WATER SUPPLIES IN LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 03D.
W71-02451

DIGITAL SIMULATION OF THE OGALLALA AQUIFER IN SHERMAN COUNTY, KANSAS,
Kansas State Geological Survey, Colby.
For primary bibliographic entry see Field 02F.
W71-02454

METHODS FOR THE COMPUTATION OF WATER BALANCE OF RESERVOIRS,
State Hydrological Inst., Leningrad (USSR).
Z. A. Vikulina.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 295-300, July 1970. 6 p.

Descriptors: *Water balance, *Reservoirs, *Methodology, Data collections, Equations, Hydrologic cycle, Meteorology, Precipitation (Atmospheric), Runoff, Evaporation, Water storage, Spillways, Temperature, Humidity, Wind velocity, Synoptic analysis, Hydrologic budget, International Hydrological Decade.
Identifiers: *Surface inflow, Outflow.

Methods of water balance computations of reservoirs (USSR) from measurements of hydrometeorological parameters are presented. The accuracy of computations, as well as the duration of the design interval are governed by the accuracy of determination of balance components. During the operation of reservoirs, the balances are computed for monthly and yearly intervals. (Woodard-USGS)
W71-02460

PRELIMINARY INVENTORY OF THE WATER RESOURCES OF IDAHO.
Idaho Univ., Moscow. Water Resources Research Inst.

Idaho Water Resource Board Report, 1968. 598 p, 242 fig, 38 map, 52 tab.

Descriptors: *Water resources, *Idaho, Surface waters, Groundwater, Water quality, Streams, Streamflow, Lakes, Runoff, Flow rates, Water yield, Climatology, Reservoirs, Consumptive use, Water control, Water rights, Hydrologic data, Irrigated land, Aquifers, Meteorology, Evaporation, Water balance, Hydrography, Precipitation (Atmospheric), Maps, Bibliographies.
Identifiers: *Idaho Water Resource Board.

Through contracts with various agencies, the Idaho Water Resource Board is engaged in a series of studies that will be used as a basis for supporting Idaho's position in regional and interstate basin investigations, in the development of a State Water Plan, and for informational reports for private or public use. Historical records as well as current conditions are utilized to identify the sources of water, the magnitude of yields and flows, the dependability of the supply, the character of the water, and the extent of water use. The report is organized into chapters on climatology (atmospheric water resources), surface water, groundwater, water use and water control, and water rights. An appendix contains numerous supporting data and a comprehensive bibliography. A very valuable part of the report is the extensive atlas that includes maps showing climatological information, surface water supply information, availability of groundwater to wells, presently irrigated land, locations of decreed water rights, and other hydrologic and water use information. (Woodard-USGS)
W71-02471

08. ENGINEERING WORKS

8A. Structures

REPORT ON FOURMILE RUN FLOODING, ALEXANDRIA, VIRGINIA.
Greeley and Hansen, Chicago, Illinois.

Report to City of Alexandria, Virginia, April 1968. 66 p, 14 fig, 5 tab.

Descriptors: *Flood protection, *Flood control, *Storm runoff, *Urbanization, *Drainage engineering, *Storage, Maximum probable flood, Virginia, Flash floods, Land development, Channel improvement, Flood plains, Construction costs, Planning, Flood plain zoning, Runoff.
Identifiers: *Fourmile Run, Arlington County, Alexandria, Arlandria.

General design criteria are developed along with a basis of design for the construction of engineering works to protect property from flooding along Fourmile Run between the stream's outlet to the Potomac River and the Shirley Highway. Fourmile Run carries stormwater runoff from an 18.5 square mile drainage area in Arlington County. Extensive damage to commercial and residential properties results from flash floods, particularly in the Arlandria area at the North boundary of the City of Alexandria. The data obtained on the maximum flood of record, August 20, 1963, were considered in the study. The recommended basis of design is to provide for a minimum discharge of 20,000 cfs, but, preferably, 24,000 cfs. The construction costs for the latter are estimated at $9,437,000, based on 1968 unit costs. The project would entail: the removal and construction of new culverts, bridges and a railroad trestle which constitute streamflow bottlenecks; provision of storage in the main stem by channel improvement and levee construction; off-channel detention storage on City-owned property located in the flood zone; and miscellaneous provisions, including possible removal of buildings from the flood plain. The Fourmile Run flash flooding problem is a prime example of similar situations in various parts of the country. (Poertner)
W71-02286

UNITED STATES V ARIZONA (CONGRESSIONAL AUTHORIZATION REQUIRED FOR FEDERAL DAM PROJECTS).
For primary bibliographic entry see Field 06E.
W71-02340

WILLIE V MINNESOTA POWER AND LIGHT CO (LIABILITY FOR FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).
For primary bibliographic entry see Field 04A.
W71-02558

STATE V UNION ELEC LIGHT AND POWER CO (FEDERAL SUPREMACY OVER NAVIGATION AND NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-02578

PEOPLE EX REL HUDSON RIVER CONNECTING RR V STATE TAX COMM'N (STATE TAXATION OF BRIDGE OVER NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-02585

DESIGNING THE LININGS OF PRESSURE TUNNELS IN ANISOTROPIC ROCK,
Bureau of Reclamation, Denver, Colo.
V. S. Eristov.
Available from NTIS as PB-193 772T, $3.00 in paper copy, $0.95 in microfiche. Translated from: Gidrotekhnicheskoe strortel'stvo, No 3, p 28-31, 1965. Bu Rec Translation No 740, March 1970. 11 p, 3 fig, 4 ref.
Identifiers: *Underground structures, Design, *Rock (Geology), Deformation, Elasticity, Shear stresses, Pressure, Grout, Anisotropy, Structural properties, USSR, Translations, Rock mechanics, *Pressure tunnel linings, *Tunneling (Excavation).

Formulas are derived for the stresses and radial deformation of a pressure tunnel lining in anisotropic rock using the theory of elasticity. The surrounding rock is assumed to be transformed into a monolithic elastic medium by grouting. It is shown that it is possible to consider, with small error, only radial components of deformation and elastic resistance. By using a constant coefficient of elastic resistance, the formulas are transformed into the formulas for an isotropic medium. The deformations obtained by these formulas for a thin lining coincide reasonably close with the corresponding deformations for an opening in an orthotropic medium loaded along the contour with a uniform radial load. An example calculation is given.
W71-02603

HYDRAULIC MODEL STUDIES OF JACKSON LAKE DAM BAFFLE BLOCKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08B.
W71-02626

TUNNEL BORING TECHNOLOGY, DISK CUTTER EXPERIMENTS IN SEDIMENTARY AND METAMORPHIC ROCKS,
Bureau of Mines, Washington, D.C.

Roger J. Morrell, William E. Bruce, and David A. Larson.
Available from the NTIS as PB-193 982, $3.00 in paper copy, $0.95 in microfiche. Report of Investigation No 7410, July 1970. 32 p, 12 fig, 6 tab.
Identifiers: *Tunnels, Boring, *Subsurface structures, Excavation, *Rocks, Fragmentation, Cutting machines (Tools), Compressive properties, Rock excavation, Performance, Force, Limestone, Marble.

Disk-cutter experiments were performed on five rock types ranging in compressive strength from 9.000 psi to 27.000 psi. A specially constructed testing machine called a linear-cutter apparatus (LCA) was designed to load and traverse a free-rolling disk cutter across a sawed rock surface. The LCA was instrumented to measure the vertical and horizontal forces acting on the cutter during the run. The ability of disk cutters to fragment rock was determined for both 60-degree and 90-degree cutting-edge angles, and relationships and regression equations were developed to predict cutter performance based on rock physical properties and applied forces.
W71-02627

8B. Hydraulics

ERROR CRITERIA IN WATER SURFACE PROFILE COMPUTATIONS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02201

NUMERICAL SOLUTION OF UNSTEADY FLOWS IN OPEN CHANNELS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-02202

PHOTOMICROSCOPIC SUBLAYER VELOCITY MEASUREMENT,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Waterways Experiment Station, Vicksburg, Miss.
Harry G. Wenzel, Jr., and Michael J. Mathews.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7724, p 2467-2480, December 1970. 14 p, 8 fig, 1 tab, 16 ref, append.
OWRR Project A-026-ILL.

Descriptors: *Open channel flow, *Boundary layers, *Turbulent flow, *Current meters, *Photography, Cameras, Tracers, Tracking techniques, Model studies, Viscosity, Turbulence, Velocity, Microscopy.
Identifiers: *Boundary layer flow, *Boundary layer photography.

The measurement of velocity in the boundary layer region of open channel flow can be a difficult problem using probes. A microscope can be used to observe the motion of small tracer particles and yield quantitative velocity data without disturbing the flow. Micron particles were photographed through a microscope as they passed through the focal field oriented parallel to the channel bottom. Particle velocity data was used to compute a mean velocity profile, turbulence intensity and skewness of the particle velocity distribution. Errors can arise in the computation of mean velocity and turbulence intensity. These errors are analyzed quantitatively. (Knapp-USGS)
W71-02206

MOTION OF SINGLE PARTICLES IN ALLUVIAL CHANNELS,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 02J.
W71-02208

EFFECTS OF PROPOSED BARRIERS ON HURRICAN SURGE HEIGHTS - REPORT 1 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
N. J. Brogdon.
Army Corps of Engineers Waterways Experiment Station Technical Report H-69-12 (No 1 of 3 Reports), September 1969. 167 p, 5 fig, 118 plate, 6 tab.

Descriptors: *Barriers, *Hurricanes, *Surges, *Bays, *Texas, *Flood protection, Gulf of Mexico, Model studies, Tides, Salinity, Distribution patterns, Structures, Navigation, Inland waterways, Discharge (Water), Flooding, Hydraulic models, Model studies, Flood control.
Identifiers: *Galveston Bay (Tex).

Design of barriers for protection of all or portions of Galveston Bay against inundation by hurricane surges required the use of hydraulic model studies of the Galveston Bay complex to verify the results of surge routings by analytical methods and to determine the effects of all proposed structures on normal tides and hurricane surge heights upstream and downstream from barrier sites. The model reproduced the coast from Freeport on the south to High Island on Bolivar Peninsula on the east and included an average width of the Gulf of Mexico of about 25 miles, measured normal to the gulf. Hurricane surges were reproduced by a horizontal-displacement type surge generator. Either of the two major hurricane protection plans tested would provide protection for the area inland from the barrier when the navigation openings were closed. The Alpha plan, located on the coastline of the Gulf of Mexico, would provide protection for a greater area since it shelters practically the entire area inland from the coastline. The Gamma plan leaves unprotected a major portion of West Bay, the entire city of Galveston, and all of East Bay. The Texas City, LaMarque-Hitchcock system, when completed, will provide protection for these towns from surges of 15 ft msl. (See also W71-02244 and W71-02245). (Woodard-USGS)
W71-02243

EFFECTS OF PROPOSED BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 2 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. H. Bobb, and R. A. Boland, Jr.
Army Corps of Engineers Waterways Experiment Station Technical Report H-69-12 (No 2 of 3 Reports), July 1970. 140 p, 2 fig, 73 plate, 9 photo, 12 tab.

Descriptors: *Barriers, *Hurricanes, *Surges, *Bays, *Texas, *Flood protection, Gulf of Mexico, Model studies, Tides, Salinity, Distribution patterns, Structures, Navigation, Discharge (Water), Flooding, Hydraulic models, Model studies, Flood control.
Identifiers: *Galveston Bay (Tex).

Migration from cities to suburban areas combined with industrial growth justifies hurricane protection for the Galveston Bay area. Models indicated two barrier schemes would protect upstream areas. Alpha barrier was located just behind the gulf beaches and Gamma barrier crossed Galveston Bay 9 miles upstream. Both schemes provided gated navigation openings across channels and gated tidal passages of sufficient capacity, located to maintain existing conditions with respect to tides, currents, salinities, and dispersion patterns. Diversion of Trinity River flow to Houston, which would increase fresh water to Buffalo Bayou and decrease fresh water to Trinity Bay, is proposed. A power station will pump up to 3500 cfs of cooling water from Houston Ship Channel and Tabbs Bay via Cedar Bayou to the plant and discharge into Trinity Bay. Tests for normal tides were made in a 1:600-, 1:60-scale model. Important conclusions were: (a) diversions from Trinity River to Houston will have no significant effects; (b) Cedar Bayou Power Station will transport water which is more saline and of poorer quality from Houston Ship Channel and Tabbs Bay to upper Trinity Bay; (c) plan 1 Alpha barrier would have no significant effects on tides, currents, salinities, or dye dispersion patterns and the area of tidal passages could be reduced 20% without adversely affecting navigation; and (d) plan 1 Gamma barrier would cause slight reductions in tidal prism and salinities. (See also W71-02243 and W71-02245). (Woodard-USGS)
W71-02244

EFFECTS OF PLAN 2 ALPHA AND PLAN 2 GAMMA BARRIERS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION FOR NORMAL TIDE CONDITIONS - REPORT 3 OF GALVESTON BAY HURRICANE SURGE STUDY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. H. Bobb, and R. A. Boland, Jr.
Army Corps of Engineers Waterways Experiment Station Technical Report H-69-12 (No 3 of 3 Reports), July 1970. 106 p, 61 plate, 7 photo, 10 tab.

Descriptors: *Barriers, *Hurricanes, *Surges, *Bays, *Texas, *Flood protection, Gulf of Mexico, Model studies, Tides, Salinity, Distribution patterns, Structures, Navigation, Fishing, Recreation facilities, Discharge (Water), Flooding, Hydraulic models, Model studies, Flood control.
Identifiers: *Galveston Bay (Tex).

Hurricane protection barriers are proposed for the Galveston Bay area. A separate model indicated that two barrier schemes would protect upstream areas: the plan 2 Alpha barrier was located just behind the gulf beaches and the plan 2 Gamma barrier crossed Galveston Bay 9 miles upstream. Both schemes provide gated navigation openings across channels and gated tidal passages of sufficient capacity, located to maintain existing conditions with respect to tides, currents, salinities, and dispersion patterns. Gated tidal passages are expensive and should be held to a minimum. Tests for normal tides were made in a 1:600-, 1:60-scale model for pre- and post-barrier conditions, and tides, currents, salinities, and dispersion patterns were observed. Important conclusions were: (a) the plan 2 Alpha barrier would have no significant effects on tides, currents, salinities, or dye dispersion patterns; (b) maximum current velocities in the navigation opening of the plan 2 Alpha barrier would be about 5.2 fps for normal tide; (c) the plan 2 Gamma barrier would cause slight reductions in the tidal prism and salinities upstream of the barrier. (See also W71-02243 and W71-02244). (Woodard-USGS)
W71-02245

VELOCITY AND SURFACE SLOPE RELATIONSHIPS IN UNSTEADY LAMINAR FLOW,
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Louis M. Laushey.
French summary. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 441-449, 1969. 9 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Groundwater movement, *Unsteady flow, *Laminar flow, Slopes, Velocity, Water table, Darcys law, Mathematical studies, Equations, Flow characteristics, Viscosity, Density, Aquifer characteristics, Permeability.
Identifiers: Darcy law modification.

The Darcy law of proportionality of water table slope and velocity is shown to be incorrect for unsteady laminar flow. When the water surface is falling, the horizontal flow velocity will be greater than that predicted by the product of the permeability and the instantaneous surface slope. An equation is proposed for the velocity if the water surface is falling. The cosine of the slope angle of the path

of surface particles is a significant slope needed to correct the Darcy law for unsteady laminar flow. (Woodard-USGS)
W71-02263

MATHEMATICAL MODELS OF GROUNDWATER FLOW,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 02F.
W71-02264

THE STUDY OF COLLECTOR WELLS BY MEANS OF VISCOUS FLOW ANALOGY,
Technical Univ. of Istanbul (Turkey). Dept. of Hydraulics and Water Power.
Kazim Cecen, Eren Omay, and Aydeniz Siginer.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 367-376, 1969. 10 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Model studies, *Viscous flow, *Aquifer characteristics, Mathematical studies, Equations, Hydraulic conductivity, Soil profiles, Laminar flow, Diffusion, Boundaries (Surface), Laboratory tests, Velocity.
Identifiers: *Collector wells, *Analogy.

The hydraulics of horizontal collector wells completely penetrating the horizontal impervious base of an isotropic, homogeneous medium is studied by means of viscous flow analogy. The basic idea is to consider a well with an infinite number of collectors in an isotropic medium and an unconfined aquifer. The radial flow towards a horizontal well has been simulated by an apparatus, in which the distance between the plates varies exponentially, thus insuring similarity between the differential equations of the flow in the apparatus and in nature. The apparatus is checked by considering the problem of the gravity well. The free surface and the discharge are determined for the case of a vertical well, which has an infinite number of symmetrically distrubuted collectors and completely penetrates the horizontal impervious base of an unconfined aquifer. (Woodard-USGS)
W71-02266

NON-DARCY FLOW SOLVED BY FINITE ELEMENT ANALYSIS,
Windsor Univ., Ontario. Dept. of Civil Engineering.
J. A. McCorquodale, and H. C. Ng.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 347-355, 1969. 9 p, 2 fig, 4 ref.

Descriptors: *Groundwater movement, *Free surfaces, *Hydraulic conductivity, *Structural analysis, *Methodology, Mathematical studies, Equations, Flow, Seepage, Boundaries (Surfaces).
Identifiers: *Non-Darcy flow.

The finite element method is applied to the solution of non-Darcy flow with a free surface. An effective hydraulic conductivity for each element is defined in terms of the best available solution of the system. The introduction of the effective conductivity linearizes the system of simultaneous equations thus making it possible to obtain a better solution. A theoretical solution is compared with experimental results for flow through a rectangular section. (Woodard-USGS)
W71-02267

THE INTEGRAL DISPLACEMENT OF THE FLUIDS THROUGH NONHOMOGENEOUS POROUS MEDIA,
Academia R.P.R., Bucharest.
D. Dumitrescu, and V. Ionescu.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 4 (Subject D), Science Council of Japan, Kyoto, p 329-337, 1969. 9 p, 2 fig, 6 ref.

Descriptors: *Porous media, *Underground storage, *Groundwater movement, *Flow, *Fluid friction, Injection wells, Pressure, Interfaces, Fluid mechanics, Mathematical studies, Equations.
Identifiers: *Non-homogeneous fluids, Fluid displacement.

General equations of motion are used to solve the problem of displacement of a fluid which saturates a non-homogeneous reservoir by another fluid introduced under pressure when there is an interface between the two fluids. (Woodard-USGS)
W71-02268

PHENOMENA OF TURBULENT HORIZONTAL TRANSPORT AND DIFFUSION IN THE TIDAL COASTAL SEAS AND APPLICATION TO THE ENGLISH CHANNEL,
Grenoble Univ. (France). Faculte des Sciences.
For primary bibliographic entry see Field 02L.
W71-02305

FOUR-POINT METHOD OF CHARACTERISTICS,
Technische Hogeschool, Delft (Netherlands).
Michael B. Abbott, and Adrianus Verwey.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7763, p 2549-2564, December 1970. 16 p, 11 fig, 1 tab, 5 ref, 2 append.

Descriptors: *Computer programs, *Analog computers, *Open channel flow, Channel morphology, Numerical analysis, Unsteady flow, Waves (Water), Computer models, Mathematical models.
Identifiers: *Method of characteristics, Computer plotting.

Conservation laws in two independent variables have a four-point symmetry when expressed in normal or characteristic form. For nearly horizontal flows, this symmetry is notated and translated into easily programmed numerical operators. Simple starting and boundary subroutines are described. The output is especially well adapted to digital-analog plotting techniques, with an accuracy superior to any current difference scheme. Bed slopes and resistance terms can be easily introduced, but the method becomes less viable for general streamflows, with changes of channel section. (Knapp-USGS)
W71-02431

PERIODIC PERMANENT ROLL WAVES,
California Univ., Irvine. Dept. of Civil Engineering.
Richard R. Brock.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY12, Paper 7764, p 2565-2580, December 1970. 16 p, 9 fig, 1 tab, 8 ref, append.

Descriptors: *Open channel flow, *Waves (Water), *Unsteady flow, *Supercritical flow, Sand waves, Bores, Surges, Model studies, Hydraulic models, Hydraulic jump.
Identifiers: *Open-channel shocks.

Two theories for periodic permanent roll waves are based on the shallow-water wave equations for the gradually varied portion of the wave profile, and the shock conditions for the rapidly varied portion. In the first theory the channel slope, S, is assumed to be sufficiently small that the weight of the shock can be neglected in the shock condition. Comparison of results from this theory for small S with experimental results reveals good agreement for S equals 0.019, but rather large discrepancies for S equals 0.050, 0.084, and 0.12. In the second theory the shock weight is included in the shock condition. Using the measured shock profiles to evaluate the weight of the shock yields theoretical predictions which are in substantial agreement with the experimental results. (Knapp-USGS)
W71-02432

COMPUTATION OF OPEN-CHANNEL SURGES AND SHOCKS,
Thessaloniki Univ., Salonika (Greece). School of Agriculture; and California Univ., Davis. Dept. of Water Science.
For primary bibliographic entry see Field 02E.
W71-02433

HYDRAULIC MODEL STUDIES OF JACKSON LAKE DAM BAFFLE BLOCKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
P. H. Burgi.
Available from NTIS as PB-194 001, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-12, March 1970. 12 p, 9 fig, 4 tab.

Descriptors: Idaho.
Identifiers: *Sluice gates, Bafles, *Dams, Sluice gates, Hydraulic models, Sluices (Hydraulic engineering), Deterioration, Abrasion, Diverters, Flow distribution, Eddies, Jackson Lake (Wyoming), Jackson Lake dam.

Model studies of the Jackson Lake Dam sluice outlets were conducted to determine the effectiveness of the existing baffle blocks. Tests were run without baffle blocks with baffle blocks and with an end sill. Evaluation of the various configurations was based on scour patterns resulting from each test. Tests without baffle blocks resulted in a prohibitive scour pattern. The end sill yielded a slight improvement in the scour pattern over that of the existing baffle blocks. Sluice operating arrangements were suggested.
W71-02626

8D. Soil Mechanics

INVESTIGATIVE MINE SURVEY OF A SMALL WATERSHED, A FIELD INVESTIGATION TO LOCATE AND DEFINE UNKNOWN OR HIDDEN DRIFT MINE OPENINGS IN THE BROWNS CREEK WATERSHED OF THE WEST FORK RIVER IN WEST VIRGINIA.
Halliburton Co., Duncan, Okla.
For primary bibliographic entry see Field 05G.
W71-02275

GILGAI IN THE QUATERNARY,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
For primary bibliographic entry see Field 02G.
W71-02505

8F. Concrete

FIRST PROGRESS REPORT ON EVALUATION OF REINFORCED PLASTIC MORTAR PIPE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08G.
W71-02294

DETERMINING VOLUME AND PRESSURE OF ENTRAPPED AIR IN CONCRETE AND POROUS ROCK MATERIALS SATURATED WITH WATER,
Bureau of Reclamation, Denver, Colo.
M. Z. Simonov.
Available from NTIS as PB-193 659T, $3.00 in paper copy, $0.95 in microfiche. Translated from: Betonizhelezoleton No 5, p 35-36, 1969. Bur of Reclamation, Translation No 824, December 1969. 11 p.
Identifiers: *Concrete, Porosity, *Construction materials, Test methods, *Rock (Geology), Air, Water, Volume, Test equipment, USSR, Translations, Pore pressure, Aggregates (Materials).

Properties of lightweight concretes depend on the conditions for interaction between 2 capillary systems, one in the cement paste and the other in

the porous aggregate. Air is entrapped in concrete capillaries during movement of water in the aggregate capillaries from the periphery to the center or during unilateral contact of porous materials with water due to nonuniform water movement in capillaries of different diameters. A pressure gradient depending on the density increase in the cement paste develops in the contact between the cement paste and the aggregate. This phenomenon explains why lightweight concrete can have greater compressive strength and impermeability than ordinary concrete made under exactly comparable conditions. Pressure of entrapped air can significantly exceed 1 atm. This pressure is determined by computations based on experimental data. Apparatus and methods used to make the necessary measurements are described and then the computations given to convert them to values for the volume and pressure of entrapped air. This method can also be used to determine the actual total volume of interconnected (open) and closed pores and capillaries and the rate of water absorption for negative and atmospheric pressures.
W71-02610

8G. Materials

FIRST PROGRESS REPORT ON EVALUATION OF REINFORCED PLASTIC MORTAR PIPE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Carl E. Selander, Fred E. Causey, Amster K. Howard, Jr. and Kenneth B. Hickey.
Available from NTIS as PB-194 492, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-34, August 1970. 66 p, 13 tab, 36 fig, 7 ref.

Descriptors: Plastics, Elastomers, Polymers, *Pipes, Mortars, *Plastic pipes, Creep, Durability, Crushing, Fatigue (Mechanics), Laboratory tests, *Performance tests, Scale, Environmental tests, Field tests, Environmental effects, Resins, Strength, Deflection, Properties, Strain, Specifications.
Identifiers: *Pipe tests, Scale effect, Buried pipes, Glass reinforced plastics, *Reinforced plastic mortar pipe, Polyesters, Loading tests.

The report of the study comprises laboratory and field programs, and preparation of specifications and design. The laboratory program consists of (1) Series A - Basin Properties: (2) Series B - Scaling Factors; (3) Series C - Stiffness Correlations; and (4) Load tests on pipe buried in soil. The basic properties are being determined through fatigue, crush, burst, creep, and stiffness studies after exposure in environments of sulfuric acid, pH5; sodium hydroxide, pH9; synthetic soil extract pH7.4 to 8.2 tap water; and distrilled water. Controls and air specimens arae also being tested. Scaling factors are to computed from 12-, 24-, 36-, and 48-in. (30.48-, 60.96-, 91.44, and 121.92-cm) Class 60 irrigation pipe. Conclusions at this point are: (1) RPM pipe appears to follow the stress agin curve for plastics, (2) good stiffness correlation is shown between classes of irrigation pipe, (3) the Iowa Formula for flexible pipe design may require reevaluation for use with RPM pipe, and (4) changes in properties caused by the different environmental exposures appear to be similar, with good chemical resistance apparent.
W71-02294

POLYSULFIDE CANAL CONTRACTION JOINT SEALER, LABORATORY TESTS TO DETERMINE THE EFFECT OF EARLY IMMERSION ON COAL-TAR EXTENDED POLYSULFIDE SEALER PLACED IN FRESH CONCRETE,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Harry K. Uyeda.
Available from NTIS as PB-194 405, $3.00 in paper copy, $0.95 in microfiche. Report No. REC-OCE-70-29, July 1970. 13 p, 2 tab, 5 fig, 1 ref.

Identifiers: *Polysulfide resins, *Sealers, *Joint sealers, Polysulfide resins, *Concretes, Joint sealers, *Canals, Submerging, Tension tests, Degradation.

Laboratory test show the effect of early immersion on the performance of polysulfide sealer extruded into the fresh concrete of contraction joint grooves. Tensile test results indicate that sealer-concrete bond is a function of the cure time prior to immersion. Although one-day cure time was found to be the minimum acceptable in these tests, several days' curing before immersion improved performance significantly.
W71-02296

GLASS-FIBER REINFORCED POLYESTER LINING,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
Michael E. Hickey.
Available from NTIS as PB-194 527, $3.00 in paper copy, $0.95 in microfiche. Report No REC-OCE-70-36, August 1, 1970. 12 p, 3 tab, 7 fig.

Descriptors:
Identifiers: *Canal linings, Reinforced plastics, *Polyester resins, Canal linings, Casting, Tensile strength, Leakage, Puncture resistance, Field tests, On site construction, *Glass fibers.

Information from an experimental field installation of onsite manufactured (cast-in-place) glass-fiber-reinforced polyester resin canal lining indicated that the lining as installed was not satisfactory. However, the process with further development has definite possibilities for canal lining. Laboratory tests of field test sections of cast-in-place and precast glass-fiber-reinforced polyester lining indicated that the material contained flaw areas of resin not saturating the glass mats, resulting in structural weakness and high water permeation. Test samples of flow-free areas showed that the lining was watertight, tough, strong, and similar to reinforced plastic structural panels used in roofing and skylight construction. Durability of the lining will be determined by periodic examinations of field test sections.
W71-02300

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

INTERNATIONAL HIGHER SUMMER COURSES FOR INSTRUCTORS AND SPECIALISTS IN HYDROLOGY,
Moscow State Univ. (USSR). Dept. of Geography.
V. D. Bykov.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1256-1265, published by Univ of Illinois, 1969. 10 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Training, *Schools (Education), Research and development, Universities, Manpower, Geology, Water resources, Hydrogeology, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Water resources education, *USSR.

The objective of the International Summer Higher Hydrological Courses in Moscow is to familiarize the participants with the latest achievements of Soviet and foreign hydrology, with trends and ways of further development of a number of hydrological problems. Lectures will be delivered in the Russian language with simultaneous interpretation into English. Practical and laboratory studies will be conducted in Russian with interpretation into English. Curriculum for each academic year provides study of one of the most important problems in hydrology on the basis of the latest scientific achievements as well as consideration of further development of research. The most important hydrological subjects to be considered are the following: calculations of streamflow, hydrological forecasting, modern technique and measuring instruments used in hydrology, control of streamflow, and hydrophysical research into thermal conditions, evaporation, and phenomena and processes related to ice. (Knapp-USGS)
W71-02220

HYDROLOGICAL EDUCATION IN CZECHOSLOVAKIA AND EASTERN EUROPE,
Prague Agricultural Univ. (Czechoslovakia). Dept. of Water Resources.
Jaromir Nemec.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1246-1255, published by Univ of Illinois, 1969. 10 p, 2 tab.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Czechoslovakia.

Hydrological education in Czechoslovakia is briefly described. While undergraduate university education in hydrology is available, students have no interest in it. An undergraduate university education is also offered in Czechoslovakia in hydrogeology jointly with engineering geology. In this last field of specialization, the interest of students, and their prospects of employment, are considerably larger. On the other hand, a postgraduate and highly specialized education is considered as most important for the advancement of Czechoslovak hydrology. Thus, in addition to a regular postgraduate study leading to a doctor's degree, postgraduate courses of a duration of six months are being organized to help the training of highly qualified hydrologists. (Knapp-USGS)
W71-02221

HYDROLOGIC EDUCATION IN SPAIN,
Institute of Hydrology, Madrid (Spain).
R. Heras.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1236-1245, published by Univ of Illinois, 1969. 10 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Spain.

Centers and institutes in Spain where teaching is conducted on miscellaneous aspects of hydrology and on subjects either directly or indirectly related to hydrological problems are briefly described. These subjects are offered in universities or technical schools as a part of their programs. In addition, specialized centers where long or short courses or seminars on various specialized topics in hydrology are given are listed. The school of Hydrology established by the Instituto de Hidrologia and spon

ored by the Consejo Superior de Investigaciones Cientificas, is now the only center which organizes specific and continuous courses on hydrology on both surface water and groundwaters. (Knapp-USGS)
W71-02222

CENTRE OF APPLIED HYDROLOGY, HYDRAULICS RESEARCH INSTITUTE, FEDERAL UNIVERSITY OF RIO GRANDE DO SUL,
Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil).
Jose Leite de Souza.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1225-1235, published by Univ of Illinois, 1969. 11 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories, Model studies, Technology, Computers, Instrumentation.
Identifiers: *Water resources research, *Water resources education, *Brazil.

A Center of Applied Hydrology was set up at the Hydraulics Research Institute of the Federal University at Rio Grande do Sul, Brazil. This Institute is the largest Hydraulics laboratory in Brazil. The facilities include: a Coastal-Research Hall; a River Research Hall; a hall housing the large-scale canal for basic research in river morphology; a sedimentation laboratory; and the central building, which accommodates the administration, offices, library, lecture rooms, the teaching laboratory, two shops, etc. Undergraduate students in Civil Engineering, Mechanical Engineering, Chemical Engineering, Geology and Agricultural Sciences of the Federal University of Rio Grande do Sul do laboratory work in Fluid Mechanics and Hydraulics. The sub-professional training will prepare people for hydrological activities in general and for both field and office activities. The Center of Applied Hydrology will grant a diploma of Master of Science in Applied Hydrology. (Knapp-USGS)
W71-02223

HYDROLOGY IN COLOMBIA,
Universidad de los Andes, Bogota (Columbia). Center of Technical Studies and Investigations in Hydraulics.
Carlos Angulo.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1219-1224, published by Univ of Illinois, 1969. 6 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Colombia.

Columbia is in northern South America with coasts on both the Atlantic and the Pacific Oceans. Different climatic areas range from a tropical desert in the northeast with an annual precipitation of 4 inches to a tropical rainy zone along the Pacific Coast with an annual precipitation of 450 inches. The country is clearly divided in two zones: the mountainous western zone where 95% of Colombians live, and the completely undeveloped plains of the east. The Colombian Meteorologic and Hydrologic Service is at present studying the location of the existing Hydrometric Stations and will develop a national network. There are about ten universities offering the equivalent of a Bachelor's degree in Engineering in a five year course and two universities offering a Master's Degree in an additional year. Hydrology enters into the Civil Engineering Program as no university has a Department of Hydrology. Hydrology is taken as a compulsory course in most universities and includes a rainfall and streamflow data, evaporation and transpiration, groundwater, the unit hydrograph method, flood frequency analysis and reservoir planning. Urban Hydrology is usually included in a compulsory Sanitary Engineering course. (Knapp-USGS)
W71-02224

EDUCATION IN HYDROLOGY IN JAPAN,
Kyushu Univ., Fukuoka (Japan).
Masatugu Murakami.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1209-1218, published by Univ of Illinois, 1969. 10 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Japan.

Hydrology or related sciences are taught in Japan's Departments of Civil Engineering, Technical Engineering, Agricultural Civil Engineering, Forestry Engineering, Agriculture, Geophysics, Geography, Earth Science, Oceanography, and Biology. In some universities hydrological science is taught as a part in courses of water resources engineering, river engineering or water works engineering in the Department of Civil Engineering. In some Departments of Biology topics on water purification are included in applied freshwater biology. A group training course in groundwater resources development for groundwater technicians from Asian developing countries is held every year in Tokyo. Lectures are on hydrogeology, groundwater hydrology, well hydrology, physical prospecting, photo-geology and water quality. (Knapp-USGS)
W71-02225

HYDROLOGIC EDUCATION IN THE FEDERAL REPUBLIC OF GERMANY,
Technische Hochschule, Hanover (West Germany).
K. Lecher.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1191-1194, published by Univ of Illinois, 1969. 4 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Federal Republic of Germany.

In the universities of the Federal Republic of Germany hydrology does not exist as an independent course of studies. Lectures in hydrology are given within the frame of more general studies, such as in hydraulic constructions in the education of civil engineers, in the sciences of agriculture and forestry, in geography, in geophysics and via hydrogeology in the education of geologists; the hydrologic education is mainly aiming at the practical use, the so-called 'Applied Hydrology.' The consequence is that hydrologists come from all these special fields and that their hydrologic work is strongly characterized by their respective basic studies. (Knapp-USGS)
W71-02226

HYDROLOGIC EDUCATION IN INDIA,
College of Engineering, Madras (India). Dept. of Hydraulic Engineering.
V. C. Kulandaiswamy.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1178-1190, published by Univ of Illinois, 1969. 13 p, 2 append.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *India.

In the Universities, Institutes of Science and Technology and Affiliated Colleges in India, courses in hydrology and topics related to hydrology form part of the curriculum in departments of engineering, geology, agriculture and meteorology. A general discussion surveys the facilities available for hydrologic education in Engineering Colleges, Engineering Universities and Institutes of Science and Technology in India. (Knapp-USGS)
W71-02227

HYDROLOGIC EDUCATION IN AUSTRALIA AND NEW ZEALAND,
Lincoln Coll., Canterbury (New Zealand). Dept. of Agricultural Engineering.
J. R. Burton.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1156-1177, published by Univ of Illinois, 1969. 22 p, 7 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Australia, *New Zealand.

Education in hydrology in Australia and New Zealand is summarized. Hydrology in Australia is largely the function of the civil engineer, and hydrologic teaching is almost entirely restricted to the engineering schools. Applied hydrology is first taught in undergraduate courses, and two schools in particular (the School of Civil Engineering of the University of New South Wales and the School of Agricultural Engineering of the University of Melbourne) provide more extensive teaching in the final undergraduate year, but serious specialization in hydrology and water resources technology is only available in postgraduate courses. The only significant postgraduate programs currently available in Australia are offered by the School of Civil Engineering of the University of New South Wales. The major university research effort in hydrology is centered at the University of New South Wales and its associated Water Research Laboratory. The major center for university research in water resources is the Agricultural Engineering Department of Lincoln College with the associated New Zealand Agricultural Engineering Institute. (Knapp-USGS)

W71-02228

HYDROLOGICAL EDUCATION IN THE UNITED KINGDOM,
Imperial Coll. of Science and Technology, London (England).
M. J. Hall.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1136-1155, published by Univ of Illinois, 1969. 20 p, 1 tab, 8 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *United Kingdom.

Although selected aspects of the subject are contained within the scope of most undergraduate courses in both civil engineering and geography, the teaching of hydrology in British universities is concentrated at postgraduate level. No university in the United Kingdom offers an undergraduate course leading to a degree in hydrology, but there are at present seven full-time postgraduate courses of from 9 to 12 months' duration devoted to water resources technology. Five of the seven courses are based in departments of civil engineering. No British university has a department of hydrology. An analysis of the numbers of students attending the above-mentioned courses during the four years 1965-69 has shown that three out of every five were from outside the United Kingdom. (Knapp-USGS)
W71-02229

HYDROLOGIC EDUCATION IN CANADA,
Saskatchewan Univ., Saskatoon. Dept. of Agricultural Engineering; and Saskatchewan Univ., Saskatoon. Div. of Hydrology.
Don M. Gray.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1125-1135, published by Univ of Illinois, 1969. 11 p, 2 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Canada.

While training in specific areas of hydrology is offered at many Canadian Universities, this training is primarily at the graduate level and oriented consistent with the 'classic' Departmental Structure. Under this system, the primary responsibility of the student is to satisfy Departmental requirements for the degree more than to develop competence in his broad field of study. Excellent programs can be found at: University of British Columbia--Oceanography and Forest Hydrology, University of Alberta (Edmonton)--River Engineering, Queen's University and Ecole Polytechnique--Hydraulics, Guelph--Surface Hydrology. Different approaches being used within Canadian Universities to develop interdisciplinary scope in Hydrologic Education are summarized. (Knapp-USGS)
W71-02230

EDUCATION AND RESEARCH IN HYDROLOGY IN FRANCE,
National School of Bridges and Roads, Paris (France).
Jean J. Fried.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1109-1124, published by Univ of Illinois, 1969. 16 p, 1 fig.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *France.

Hydrological education in France is briefly summarized. Hydrology is taught the second or the third year in professional schools. It comprises basic hydrology and is developed according to the general trend of each school: for instance the 'Ecole des Ponts et Chaussees' (Bridges and roads) specializes in open-channel flow and urban hydrology. Students who enter the University take basic geology courses and have almost no theoretical courses such as mathematics; they are immediately specialized in geology and related fields, and after three or four years sit for the 'maitrise de geologie' (which is in between B.Sc. and M.Sc.). Most hydrological studies are taken after the 'maitrise', in the 'third cycle' and lead to doctorate theses. The third cycle courses are taught in the four main Universities; Paris, Bordeaux, Montpellier and Toulouse. Education in hydrology is still lagging far behind research; it is very academic without much field work and is somewhat neglected by the great engineering schools which provide the core of French scientists and engineers. These schools are, however, able to educate hydrologists with a sound base in theoretical topics, so that they can define and apply new theories and do rigorous experimental work. (Knapp-USGS)
W71-02231

HYDROLOGIC EDUCATION IN ISRAEL,
Technion - Israel Inst. of Technology, Haifa. Water Resources Research Center.
Jacob Bear.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1086-1108, published by Univ of Illinois, 1969. 23 p, 2 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Universities, *Training, Research and development, Manpower, Schools (Education), Geology, Water resources, Water resources development, Forecasting, Hydrology, Hydraulics, Engineering, Professional personnel, Scientific personnel, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education, *Israel.

The syllabi of courses in hydrology and some related subjects at the Technion - Israel Institute of Technology and at the Hebrew University of Jerusalem are listed. Courses are also offered at the Graduate School of the Weizmann Institute of Science especially in the field of geochemistry, isotope geology and the use of isotopes in hydrology. At the Technion, courses are given at the Departments of Civil Engineering and Agriculture Engineering. Both at the Technion and at the Hebrew University, the syllabi are dictated to a large extent by the courtry's present, and especially future needs. These needs also include training of hydrologists who will go and help develop water resources in developing countries, a task which Israel undertakes now in various parts of the world. Field trips which acquaint the student with actual problems are part of the educational programs, as are examples and exercises taken from the practice in Israel. Research in hydrology at the Technion and other Institutions of Higher Education has always been oriented towards solving pressing problems posed by the hydrologist and water resources planner in the field. Close cooperation exists between the staff at these institutions and the practicing engineers. (Knapp-USGS)
W71-02232

AN INTRODUCTION TO TERRESTRIAL HYDROLOGY - A GAP IN TRAINING,
National Academy of Sciences-National Research Council.
L. A. Heindl.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1079-1085, published by Univ of Illinois, 1969. 7 p.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Training, *Universities, Manpower, Research and development, Human resources, Schools (Education), Geology, Water resources, Water resources development, Hydrology, Hydraulics, Engineering, Planning, Research facilities, Laboratories, Technology, Computers.
Identifiers: *Water resources research, *Water resources education.

The need for and the possible content of a course in hydrology that would present the scientific and practical aspects of water studies at an early stage in the university curriculum are discussed. The purposes of the course would be to provide an introduction to hydrology and to its interrelationships with man's concern for his welfare and environment and to interest young students in careers in hydrology. The base for such a course would be the broad concept of hydrology as accepted by the University Council on Water Resources and the International Hydrological Decade, whose definitions of hydrology, in turn, are based on one offered by the Federal Council for Science and Technology. Under this concept hydrology is the science that treats of the waters of the earth, their occurrence, circulation and distribution, their chemical and physical properties, and their reaction with the environment including their relation to living things. This broad concept would be stressed. However, the main thrust of the course should be on the hydrology of land areas. (Knapp-USGS)
W71-02233

TEACHING AIDS AND HYDROLOGY,
Texas Univ., Austin. Dept. of Civil Engineering.
Walter L. Moore.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1044-1078, published by Univ of Illinois, 1969. 35 p, 1 fig, 2 append.

Descriptors: *International Hydrological Decade, *Conferences, *Bibliographies, *Education, *Reviews, Libraries, Research and development, Publications, Universities, Schools (Education), Water resources development, Hydrology, Hydraulics, Training, Laboratories, Computers, Research facilities.
Identifiers: *Water resources research, *Water resources education, *Textbooks.

The nature of teaching aids is reviewed in relation to the teaching and learning process; some particular forms of teaching aids are demonstrated, and potential uses of various aids for some subdivisions in hydrology are discussed. A list of current books available in the United States includes general books on hydrology which either include a treatment of the entire subject matter of hydrology or

some major portion of the topic. A much longer list giving information on books in other fields which include treatments of some specific and usually rather limited topics of hydrology and a list of books on physical oceanography is included. The number of motion pictures dealing specifically with hydrological subjects is quite limited. The role of the laboratory in teaching hydrology is yet to be developed. Equipment in conventional hydraulic laboratories are applicable to the teaching of some aspects of hydrology. (Knapp-USGS)
W71-02234

CURRICULUM DEVELOPMENT IN HYDROLOGY,
Arizona Univ., Tucson. Office of Hydrology and Water Resources.
Daniel D. Evans, and John W. Harshbarger.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1024-1043, published by Univ of Illinois, 1969. 20 p, 1 fig, 1 tab.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Training, *Manpower, Research and development, Human resources, Schools (Education), Universities, Water resources development, Hydrology, Hydraulics, Geology, Hydrogeology, Water resources, Engineering, Planning, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education.

Knowledge required for understanding and solving complex water problems may be considered as a continuum extending from the basic physical and biological sciences, through the applied natural sciences, and a thrust into the behavioral sciences. The breadth of knowledge encompassed is greater than in any other field of study. A complete educational program in hydrology and water resources needs to provide the opportunity for students to specialize in any segment of the continuum as well as the opportunity for others to obtain a general education across the continuum. In order to attempt to fully understand the manifold phases of the hydrologic cycle, the hydrologist must draw upon the knowledge of meteorology, geology, soil science, biology, and engineering, and make constant use of the fundamentals of chemistry, physics, mathematics and statistics. In the solution of everday water problems he needs to collaborate with engineers, economists and other scientists. To analyze problems in water resources involving man and society a scientist must have a basic understanding of hydrology, economics, social sciences, political science, water law, statistics, and operations research. Suggestions are offered for forming university curricula to meet those requirements at undergraduate and graduate levels. (Knapp-USGS)
W71-02235

RELATIONS OF UNIVERSITY HYDROLOGIC PROGRAMS WITH GOVERNMENT AGENCIES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
For primary bibliographic entry see Field 09D.
W71-02236

COMMENTS ON SOME RECENT TRENDS IN HYDROLOGY RESEARCH,
Office of Water Resources Research, Washington, D.C.
E. D. Eaton.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1 st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 974-993, published by Univ of Illinois, 1969. 20 p, 14 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Research and development, *Education, *Research factilities, Water resources development, Forecasting, Hydrology, Hydraulics, Groundwater movement, Snow, Ice, Permafrost, Precipitation (Atmospheric), Planning, Projects, Soil water, Lakes, Soil-water-plant relationships, Laboratories, Model studies, Technology, Computers, Instrumentation, Mathematical studies, Systems analysis.
Identifiers: *Water resources research.

Some of the trends in current hydrology research are discussed including some of the research subjects likely to receive increasing attention in the coming years. All seem to relate to developing better understanding of, and better competence to deal with extensive, complex, multivariate systems; the research design and technology generally utilized are well suited to subjects so characterized. Scientific advances are providing powerful predictive tools. Two aspects of system-analysis type research especially require strengthening. One of these is improvement of the design of hydrology research on problems that are strongly influenced by biological and social factors which have the effect of making problem boundary conditions obscure and instable. A second aspect of system-analysis hydrology research that needs strengthening is the processes of appraising risk in situations affecting human life and well-being. (Knapp-USGS)
W71-02237

HYDROLOGIC TRAINING FOR WATER RESOURCES DEVELOPMENT,
Georgia Inst. of Tech., Atlanta. Water Resources Center.
Carl E. Kindsvater, and Willard M. Snyder.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 962-973, published by Univ of Illinois, 1969. 12 p, 1 tab, 2 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Manpower, *Professional personnel, Governments, Universities, Human resources, Hydrology, Scientific personnel, Planning, Projects, Research facilities, Laboratories.
Identifiers: *Water resources research, *Water resources education.

New university programs in hydrology are predominantly at the graduate level and they tend to attract an inordinately large number of mature students with a variety of job experiences. The result is an exceptionally responsive feed-back relationship between job requirements and educational programs. Training the hydrologist for water resources development implies training for technological, not scientific endeavor. The hydrologist is, however, a full-fledged professional, springing generally from a bachelor's-degree education in a field such as civil engineering, geology, or soil physics. Breadth in the hydrologist's training implies sufficient knowledge of the natural and social sciences to communicate effectively in an interdisciplinary environment. The hydrologist should have a solid foundation in modern operational mathematics, and he should have basic training in operations research, systems analysis, statistics and probability, and computer technology. The hydrologist must also be educated in considerable depth in all of the allied disciplines, including the auxiliary hybrids known as hydrometeorology and hydrogeology. (Knapp-USGS)
W71-02238

MANPOWER NEEDS IN HYDROLOGY,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Arno T. Lenz.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 954-961, published by Univ of Illinois, 1969. 8 p, 1 tab.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Manpower, Universities, Governments, Engineering, Employment, Human resources, Hydrology, Professional personnel, Scientific personnel, Planning, Projects, Research facilities, Laboratories.
Identifiers: *Water resources research, *Water resources education.

The present manpower situation is reviewed with regard to needs in hydrologic education. Competence in hydrology requires at least minimal competence in one or more of the other earth sciences and the application of hydrology frequency involves the application of civil, hydraulic and sanitary engineering because water is such an important part of man's environment. Hydrologists have entered into broader fields, or scientists from broader fields now consider themselves hydrologists. Greater depth of concentration is also of increasing importance. The professional manpower needs of government agencies, universities, consulting firms, and other employers of hydrologists are briefly summarized. (Knapp-USGS)
W71-02239

INTERNATIONAL COOPERATION IN HYDROLOGIC EDUCATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Maurice L. Albertson.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 938-953, published by Univ of Illinois, 1969. 16 p, 6 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Human resources, *Education, *Manpower, Training, Water resources development, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Exploration, Economics, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education.

International cooperation in education in general, and such cooperation in water resources or hydrologic education in particular are discussed, treating the concept of human resources development as more important than physical resources to developing countries. The sub-category of manpower resources must, of course, consider both quantity and quality of the manpower resource. The information resource is the body of knowledge available for all mankind, and the cultural resources include the over-all cultural background, as well as the institutional structure which is necessary for the manpower resource to be effective. Basically, the necessary human resources can be provided either from indigenous personnel or from human resources outside the country in question. Both sources of human resources must be drawn upon very heavily. (Knapp-USGS)
W71-02240

INTERNATIONAL HYDROLOGIC EDUCATION THROUGH FELLOWSHIPS AND ASSISTANTSHIPS,
Nevada Univ., Reno. Desert Research Inst.
William S. Butcher.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1011-1023, published by Univ of Illinois, 1969. 13 p, 4 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Education, *Grants, Research and development, Schools (Education), Universities, Training, Governments, Water resources development, Hydrology, Hydraulics, Planning, Projects, Research facilities, Laboratories, Technology.

Identifiers: *Water resources research, *Water resources education.

The education and training program in the International Hydrological Decade occurs at national and international levels. At the international level, it has been possible to set up regional training centers, as well as training courses for hydrological technicians in some of the less developed countries, by working in cooperation with various other international organizations. Many countries, working through their own National Committees, have been able to achieve substantial progress in the education and training area. From the outset, education and training has been an important part of the concern of the US/IHD National Committee. Sources of support for foreign and U. S. students in hydrology are summarized. (Knapp-USGS)
W71-02241

HYDROLOGY IN TAIWAN,
National Taiwan Univ., Taipei. Dept. of Civil Engineering.
Yen-Chi Lu.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 1195-1208, published by Univ of Illinois, 1969. 14 p, 1 fig, 3 tab.

Descriptors: *International Hydrological Decade, *Hydrogeology, *Conferences, *Water resources development, Climates, Topography, Research and development, Forecasting, Hydrology, Hydraulics, Precipitation (Atmospheric), Soil conservation, Land management, Planning, Projects, Research facilities, Exploration, Economics, Rainfall-runoff relationships, Education, Training, Laboratories, Technology.
Identifiers: *Water resources research, *Taiwan.

The physiography and hydrology of Taiwan are briefly summarized and the education in hydrology available there is outlined. The whole island is very mountainous, and only its western coastal plain is comparatively flat. Mountain slopes are steep. Rivers are short and rapid. The top soil containing gravel is shallow and easily eroded. In addition to natural factors which contribute to soil erosion, population pressure and the lack of knowledge of soil conservation among farmers make the situation even more serious. Research in recent years by hydrologists, meteorologists and hydraulic engineers in various organizations such as Taiwan Provincial Weather Bureau (TPWB); Water Resources Planning Commission (WRPC); Taiwan Power Company (TPC); Taiwan Provincial Water Conservancy Bureau (TPWCB); and Shihmen Reservoir Promotion Committee (SRPC) are described. One semester course of hydrology in the junior year is required of all civil engineering students. Several courses related to hydrology, such as water resources engineering, water supply, and sewerage engineering are available in the senior year. A two year graduate program in civil engineering was established in 1960 at the National Taiwan University, leading to a M.S. degree. There have been few students interested in specializing in hydrology. (Knapp-USGS)
W71-02242

INVENTORY OF RESEARCH PROJECTS IN THE PACIFIC NORTHWEST: SUPPLEMENT NUMBER ONE.
Federal Water Quality Administration, Portland, Oreg.

January 1970. 50 p, 7 tab, 1 fig.

Descriptors: *Research and development, *Abstracts, Documentation, Education, Training, Water pollution control, Water quality.
Identifiers: Pacific Northwest.

The status of all FWQA funded research and development projects in the Pacific Northwest as of December 31, 1969 is tabulated. Projects which were terminated in 1969 or which began prior to January 1, 1969 are listed by title, principal investigator and organization only. Projects initiated in 1969 are listed with full abstract information. Data on FWQA sponsored fellowships and traineeships for Fiscal Year 1969 is given. An introductory chapter describes the research and development program administered by FWQA. (Barich-FWQA)
W71-02307

FISCAL 1970 ANNUAL REPORT.
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 09D.
W71-02311

ANNUAL REPORT OF ACTIVITIES FOR FISCAL YEAR 1970,
Illinois Univ., Urbana. Water Resources Center.
For primary bibliographic entry see Field 09D.
W71-02319

9C. Research Facilities

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE, VOLUME I. MANAGEMENT ASSISTANCE AND PLANNING,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02288

TECHNICAL INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME II. EHS INFORMATION NETWORK ANALYSIS,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02289

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME III. LEAD MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02290

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME IV. PESTICIDES MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02291

9D. Grants, Contracts, and Research Act Allotments

RELATIONS OF UNIVERSITY HYDROLOGIC PROGRAMS WITH GOVERNMENT AGENCIES,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Robert L. Smith.
In: The Progress of Hydrology, Vol 3 - Hydrologic Education and Discussions, Proceedings 1st International Seminar for Hydrology Professors, Illinois University, Urbana, July 13-25, 1969, p 994-1010, published by Univ of Illinois, 1969. 17 p, 3 ref.

Descriptors: *International Hydrological Decade, *Conferences, *Manpower, *Education, Training, Research and development, Governments, Universities, Human resources, Scientific personnel, Professional personnel, Water resources development, Forecasting, Hydrology, Hydraulics, Planning, Projects, Research facilities, Laboratories, Technology.
Identifiers: *Water resources research, *Water resources education.

Manpower considerations are most significant in determining the nature and extent of university educational programs. In all nations, whether developed or developing, and in certain disciplines, the educational effort often requires that emphasis be placed on mass production of 'how-to-do-it' graduates. As initial needs are met, the educational programs can devote appreciably more emphasis to scientific advancement via research and graduate instruction. University-government relations must be responsive to these changing conditions. There can be no fixed formula for appraising the adequacy of university relations with government agencies. Adequate communications and forthright appraisal of relative strengths and weaknesses are fundamental to the maintenance of satisfactory relations. Some general guidelines are suggested, but their application to specific cases must recognize the evolutionary processes that are ever present. (Knapp-USGS)
W71-02236

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE, VOLUME I. MANAGEMENT ASSISTANCE AND PLANNING,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02288

TECHNICAL INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME II. EHS INFORMATION NETWORK ANALYSIS,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02289

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME III. LEAD MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02290

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME IV. PESTICIDES MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
For primary bibliographic entry see Field 10.
W71-02291

FISCAL 1970 ANNUAL REPORT.
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.

Institute for Research on Land and Water Resources, Information Report No 64, University Park, Pa., July 1970. 247 p, 2 append.

Descriptors: *Training, *Universities, *Education, Allotments, Grants, Acid streams, *Pennsylvania, Eutrophication, Water pollution, Waste water treatment, Carbonates, Hydrogeology, Watershed management, Phosphates, Water pollution sources, E. coli, Sewage effluents, Aquatic microbiology, Demand, Supply, Recreation, Social impact, Public lands, Zoning, Planning, Land use.
Identifiers: Highway economic impact, New land uses, Acquisition practices, Tourism, Soil productivity, Roadside ecology, Economic data systems.

This publication serves the dual purposes of being an annual report of the Institute and of satisfying the reporting requirements to the Office of the Water Resources Research under P.L. 88-379. Separate sections within the publication are devoted to the activities and research projects of

the Land Resources Center, Water Resources Center, and Regional Analysis Center. Indicating the interdisciplinary nature of the Institute are the 158 Institute personnel who represented 9 colleges and 27 academic departments at Penn State. Numerous broad lines of research are reported with concentrations in such areas as: pollution control; pollutant identification; renovation of waste water; management of watersheds to increase water yields; control of plant growth in streams; hydrologic and hydrogeologic studies; development of water supply and waste water systems to meet community and regional needs; highway economic impact; land use planning and zoning procedures; identification of new land uses for rural areas; development of equitable public land acquisition practices; social impact of water reservoir development; potentials of tourism and recreation; the development of computer programs for analyzing the growth potentials of economic regions; biological and engineering studies of land and water resources; economic efficiency studies; acid water neutralization; land suitability for septic tank disposal systems; soil productivity; roadside ecology; economic data systems; and costs of pollution in terms of recreation. Contains 2 appendices. (Sink-Penn State)
W71-02311

ANNUAL REPORT OF ACTIVITIES FOR FISCAL YEAR 1970,
Illinois Univ., Urbana. Water Resources Center.
Ben B. Ewing.
Annual Report No 6, July 11, 1970. 199 p.

Descriptors: Water resources, *Illinois, Training, *Universities, *Education, Allotments, Grants.
Identifiers: Water resources research, *Annual report.

The University of Illinois Water Resources Center was established in 1963 to 'encourage and coordinate university-wide planning and implementation of interdisciplinary programs for research and graduate education in water resources'. Since designation as the Title 1 OWRR 'Institute' for Illinois, the Center's activities have become statewide. This report describes research accomplishments and other activities of the Center during fiscal year 1970 and also describes plans for the remainder of the calendar year. The Center's programs are sponsored both under Title 1 of P.L. 88-379 and from other sources such as state funds. The Center's fiscal year 1970 research program included a total of 32 projects of which 13 were included in the annual allotment from OWRR, 14 were partially sponsored by matching grants from OWRR and 5 were completely sponsored with state funds. A progress report for each project is presented. (Ewing-Illinois)
W71-02319

10. SCIENTIFIC AND TECHNICAL INFORMATION

TEACHING AIDS AND HYDROLOGY,
Texas Univ., Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 09A.
W71-02234

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE, VOLUME I. MANAGEMENT ASSISTANCE AND PLANNING,
Environmental Health Service, Rockville, Md.
D. L. Morrison, D. B. Menzel, K. L. Nielsen, A. A. Levin, and C. W. Hamilton.
Available from NTIS as PB-194 410, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 83 p, 10 tab, 5 fig, 5 ref. HEW Contract CPS-69-005.
Identifiers: *Research management, Public health, *Project planning, *Public health, *Environments, Management, Management analysis, Management methods, Management planning, Pollution, Mathematical models, Forecasting, Information systems, Hazards, Hazardous materials, Monitoring, *Environmental health.

The concepts embodied in the development and implementation of a comprehensive R and D and program planning capability for EHS were examined. Environmental stressors were selected as the basis for planning rather than categorical approaches. For the mix of complex problems encountered by EHS, s system to establish priorities is required. The integrated planning system which was recommended utilizes mathematical models to assess the impacts of technology upon man and his environment and the assignment of priorities based upon quality of life indices. Specific elements of the management-assistance system which was defined include an overview environmental health planning function to provide coordinated and comprehensive planning in the man-centered ecosystem context; an impact assessment capability based upon a hierarchy of mathematical models; a threat identification function to identify and evaluate potential threats to man and the environment through intensification or extension of current use patterns of products and services or through introduction of new stressors; and an environmental health information network to provide a well-organized information base. A hierarchical approach to the development of mathematical models for prediction of the impacts of stressors upon man and the environment was described and specific examples are presented for lead in the environment. (See also W71-02289)
W71-02288

TECHNICAL INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME II. EHS INFORMATION NETWORK ANALYSIS,
Environmental Health Service, Rockville, Md.
Ralph L. Darby, Robert S. Kohn, Thomas E. Carroll, W. David Penniman, and David L. Morrison.
Available from NTIS as PB-194 411, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 128 p, 23 tab, 15 fig, 38 ref. HEW Contract CPS-69-005.
Identifiers: *Information systems, *Environmental surveys, *Research management, Public health, *Project planning, *Public health, *Environments, Environmental engineering, Information retrieval, Surveillance, Monitors, Libraries, Resources, Thesauri, Data storage, Documentation, Computer programs, *Environmental health.

The study for the Environmental Health Service is an investigation of the problems being faced in protecting man's environment from threats created by man. This study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This volume of the report concerns itself with Information Network Analysis. An investigation was made of the existing EHS information resources including the monitoring and surveillance activities. A survey was conducted of the documentation systems and libraries in order to determine their operational characteristics as related to an information network. (See also W71-02290)
W71-02289

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME III. LEAD MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
Garson A. Lutz, Arthur A. Levin, Sanford G. Bloom, Kaj L. Nielsen, and Jack L. Cross.
Available from NTIS as PB-194 412, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 129 p, 26 tab, 17 fig, 500 ref. HEW Contract CPS-69-005.
Identifiers: *Air pollution, Lead (Metal), *Lead (Metal), *Pollution, *Public health, *Project planning, Public health, Toxicity, Ecology, Mathematical models, Hazards, Diseases, Economic analysis, Fuels, Sources, Air pollution, Environments, Research management, Children, Hazardous materials, *Environmental health.

The lead model case study was undertaken to serve as a working example and to evaluate the technical, intelligence, and project information system under consideration for EHS. Occurrence and use patterns for lead within the U. S. were examined. The major categories of uses in decreasing order were production of storage batteries and accessories, gasoline antinock additives, pigments, ammunition, solder, cable covering, and caulking lead. Leaded fuels are the major source of environmental lead. Pediatric plumbism, the most significant acute health problem, arises from lead used as a pigment. The economic aspect of this problem area were investigated. While lead is very slowly absorbed from environmental sources, its gradual accumulation in the body is the basis for progressive toxicity. Additional research is required to determine the chronic effects of lead in the environment on health, and better diagnostic and therapeutic techniques are needed in support of this research. A mathematical model was developed to represent the environmental transport of the stressor lead from several sources with the subsequent intake of lead by man. This model can be used to assess the impact of contemplated actions on lead body burdens, to define R and D requirements, and to identify the needs and locations for monitoring and surveillance. A categorized bibliography for lead is included. (See also W71-02291)
W71-02290

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME IV. PESTICIDES MODEL CASE STUDY,
Environmental Health Service, Rockville, Md.
J. K. Yoss, J. W. Blaylock, M. J. Schneider, L. C. Schwendiman, and C. J. Touhill, Jr.
Available from NTIS as PB-194 413, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 53 p, 16 tab, 9 fig, 91 ref. HEW Contract CPS-69-005.
Identifiers: *Air pollution, DDT, *Water pollution, *Pesticides, Pollution, *Public health, *DDT, *Project planning, Public health, Ecology, Hazards, Hazardous materials, Models, Chlorohydrocarbons, Sources, Air pollution, Water pollution, Environments, Toxicity, Environmental health.

DDT was selected as the compound for this study due to paucity of data regarding environmental effects of other classes of pesticides. Human exposure to pesticides was examined from two major pathways; the direct pathway which deals with direct uptake from primary sources of pesticide release, and the indirect pathway which involves human exposure by translocation through air, water, or food. Reductions in accidential poisonings could be made by limiting the total toxicant contents of home packages of pesticides, and means to reduce deaths from aerial applications warrant further study of this method of application. The control of human burden of pesticides by control of food residues is only partially effective since evidence on pesticide distribution in the environment suggests that about half of the intake is from inhalation of insecticide aerosols or dust laden with insecticides. There is presently no evidence that pesticide exposure directly shortens human life. Fish and birds are more sensitive to pesticides in the environment. Fish lack the basic microsomal oxidase enzyme systems which detoxify pesticides and birds appear to be very sensitive to the sterodal hormone mimicking effects of the chlorinated hydrocarbons. (See also W71-02292)
W71-02291

TECHNICAL, INTELLIGENCE, AND PROJECT INFORMATION SYSTEM FOR THE ENVIRONMENTAL HEALTH SERVICE. VOLUME V. DIRECTORY OF EHS INFORMATION FACILITIES WITH SELECTED SUPPLEMENTARY RESOURCES,
Environmental Health Service, Rockville, Md.
Ralph L. Darby, Robert S. Kohn, Thomas E. Carroll, W. David Penniman, and David L. Morrison.
Available from NTIS as PB-194 414, $3.00 in paper copy, $0.95 in microfiche. Final Report to Consumer Protection and Environmental Health Service, June 29, 1970. 62 p. HEW Contract CPS-69-005.
Identifiers: *Research management, Public health, *Project planning, Public health, *Public health, *Environments, *Information systems, Environmental surveys, Management methods, Management planning, Management environmental engineering, Information retrieval, Libraries, Resources, Surveillance, Monitors, *Environmental health.

This study is a multifaceted and intensive investigation of the problems facing the EHS in protecting man's environment from the threats created by man. This study included the following major efforts: (1) research and development planning in the perspective of man in his total environment, (2) information network analysis, and (3) model case studies. This directory represents an inventory of information and data resources useful to the personnel of the Environmental Health Service. It is divided into three principal categories: (1) EHS-sponsored resources, (2) non-EHS resources, and (3) monitoring and surveillance activities of both the National Air Pollution Control Administration. A subject-index, an index of information facilities, and an index of the parent or sponsoring organization are provided. (See also W71-02288)
W71-02292

INVENTORY OF RESEARCH PROJECTS IN THE PACIFIC NORTHWEST: SUPPLEMENT NUMBER ONE.
Federal Water Quality Administration, Portland, Oreg.
For primary bibliographic entry see Field 09A.
W71-02307

DIRECTORY OF FEDERALLY SUPPORTED INFORMATION ANALYSIS CENTERS.
Federal Council for Science and Technology, Washington, D.C. Committee on Scientific and Technical Information.

Available from NTIS as PB-189 300, $3.00 in paper copy, $0.95 in microfiche. COSATI-70-1, January 1970. 71 p.

Descriptors: *Documentation, Data storage and retrieval, Data collections, Information retrieval.
Identifiers: *Information analysis centers, Data, *Directories, Information, Information services.

This directory of 119 Federally supported information analysis centers is descriptive, containing information on mission, scope, and services provided by the listed centers. Included are an index of subject areas covered by the centers, an index of center directors, a list of organizations, and a list of locations. The centers are numbered serially to facilitate indexing.
W71-02310

EFFECTS OF LAND MANAGEMENT ON QUANTITY AND QUALITY OF AVAILABLE WATER,
New South Wales Univ., Kensington (Australia). Water Research Lab.
For primary bibliographic entry see Field 04C.
W71-02452

BIBLIOGRAPHY OF MONTANA WATER RESOURCES AND RELATED PUBLICATIONS.
Montana Water Resources Board, Helena.

Montana Water Resources Board Inventory Series Report No 10, 1969. 91 p, 2 index, append.

Descriptors: *Bibliographies, *Water resources, *Montana, Documentation, Surface waters, Groundwater, Water supply, Water quality, Consumptive use, Water measurement.
Identifiers: Literature search.

This bibliography lists all of the known printed information, both published and unpublished, available to the Montana Water Resources Board as of December, 1968. It has been compiled as a part of the Inventory phase of the State Comprehensive Water and Related Land Resources Plan (State Water Plan). The bibliography is arranged in two sections and the material is coded so that it may be useful to researchers seeking references in any of a number of ways. The coding system is based upon the Descriptor Groups presented in the Water Resources Thesaurus published by the Office of Water Resources Research, U.S. Department of the Interior in November, 1966. Section 1, the author index, lists the complete reference alphabetically according to author. Also included are the complete code numbers for each reference. In Section 2, the code numbers are listed in sequence opposite the names of authors. With this list the researcher may locate all materials pertaining to a particular subject as listed in the Descriptor Groups in Appendix I. The list in section 2 also allows the researcher to easily segregate material on a specific river basin or county by examining the code in the second column. (Woodard-USGS)
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- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

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4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
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primary bibliographic entry see Field 02K.
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DENCE THAT POLYWATER IS A COL-DAL SILICATE SOL,
al Research Lab., Washington, D.C.
ard D. Bascom, Edward J. Brooks, and lford N. Worthington., III.
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criptors: *Water properties, *Water, *Water cture, *Silicates, *Colloids, Synthesis, Laboratests, Condensation, Electrical conductance, thesis, Spectroscopy, Water vapor, Physical perties, Viscosity, Gels.
ntifiers: *Polywater, *Anomalous water, *Sols, illaries.

lysis of residues from condensation of 'polyer' using the electron probe showed significant unts of silicon and sodium, suggesting that the sual properties of 'polywater' may be due to the ence of silica or silicate. Experiments were ducted in an apparatus designed to allow the llaries to be evacuated independently of the er to reduce the chance of spray reaching the llaries during the pump-down. Electron probe ysis of the residues from 'Pyrex' revealed sodiand silicon in easily detectable amounts. Sodiwas most strongly evident in the particulate ter within the residue and the silicon level was est near the edge. The residues from condenin silica were thinner and therefore more difit to analyze than the residues from 'Pyrex.' etheless, the electron probe revealed signifilevels of sodium and silicon in the thicker res near the edges. (Woodard-USGS)
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L SURFACE CHARACTERISTICS AND NFALL-RUNOFF-MOISTURE RELATION-PS ON COASTAL PLAIN SOILS,
urn Univ., Ala. Water Resources Research

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ymposium on World Water Balance, Vol 1, International Association of Scientific Hydrology lication No 92, p 115-121, July 1970. 7 p, 3 fig, f.

criptors: *Mapping, *Water balance, *Synoptic ysis, Rainfall-runoff relationships, Evapotranspiration, Data collections, Gaging stations, Data processing, Maps, Hydrologic cycle, Hydrologic data, Runoff, Streamflow.
Identifiers: Federal Republic of Germany.

A simple method is given for obtaining runoff maps from precipitation and air temperature data. It has proven of considerable practical value in the Federal Republic of Germany. The procedure can also be used for determining the long-term depth of runoff in areas for which runoff data are not available. Of all related factors, precipitation is the one that exerts the strongest influence on mean runoff depth and specific yield. If approximate evapotranspiration values for all stations concerned have been determined from precipitation and air temperature data, it is possible to get from the difference between precipitation and evapotranspiration approximate information on long-term mean runoff depth or specific yield. With the aid of the maps thus obtained, it is easy to determine the values required for water balance by planimetering the areas between the isolines. (Knapp-USGS)
W71-02767

SURFACE WATERS AS ELEMENTS OF THE WORLD WATER BALANCE,
Moscow State Univ. (USSR).
G. P. Kalinin, and K. Szesztay.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 102-115, July 1970. 14 p, 12 fig, 11 ref.

Descriptors: *Surface waters, *Water balance, *Hydrologic cycle, *Synoptic analysis, Hydrologic budget, Climate, Weather, Weather patterns, Rainfall-runoff relationships, Precipitation (Atmospheric), Runoff, Streamflow.
Identifiers: World water balance.

There is a sharp asymmetry in the quantitative distribution and dynamic significance of the elements of the global water system. Basic features of the surface water systems and those of the streamflow regime are specified by climatic conditions. There are well defined regional time patterns in the distribution of the annual river flow within the northern hemisphere which may be emphasized by the typical pressure topography of the troposphere during periods of western atmospheric circulation. In spite of time correlations the laws of ergodicity can be applied to annual streamflow data if they are properly adjusted and data of sufficiently large regions are synthetized. Under given climatical conditions, the amount and time variation of baseflow are controlled by geohydrological characteristics. Changes in surface area of lakes and reservoirs may considerably affect the water balance and quality regimes. (Knapp-USGS)
W71-02768

CYCLIC VARIATIONS OF RIVER DISCHARGE IN THE NORTHERN HEMISPHERE,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02778

WORLD WATER BALANCE (GENERAL REPORT),
Akademiya Nauk SSSR, Moscow. Institut Geografii.
M. I. Lvovitch.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 401-415, July 1970. 15 p, 1 fig, 6 tab, 83 ref.

Descriptors: *Water balance, *Latitudinal studies, *Earth (Planet), *Synoptic analysis, *Reviews, Hydrologic cycle, Climatic data, Meteorological data, Hydrologic data, Equations, Surface waters, Groundwater, Land, Oceans, Precipitation (Atmospheric), International Hydrological Decade.

The concept of world water balance is reviewed in general and its importance, in particular for the advancement of knowledge of hydrological processes occurring on the earth and for estimating world water resources is emphasized. A historical review of various estimates made by different scientists for different parts of the hydrological cycle is given with relevant tables. The author has made a critical study of various methods used for such estimates and has separated those elements which need further research. (Woodard-USGS)
W71-02781

SIMULATION OF THE HYDROLOGIC CYCLE OF THE GLOBAL ATMOSPHERIC CIRCULATION BY A MATHEMATICAL MODEL,
Environmental Science Services Administration, N. J., Geophysical Fluid Dynamics Lab.
Syukuro Manabe, and J. Leith Holloway, Jr.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 387-400, July 1970. 14 p, 11 fig, 20 ref.

Descriptors: *Hydrologic cycle, *Latitudinal studies, *Mathematical models, *Synoptic analysis, *Atmosphere, *Climates, *Earth (Planet), Circulation, Equations, Hydrology, Meteorology, Climatology, Land, Oceans, International Hydrological Decade.

A mathematical model of the global atmospheric circulation is constructed. The model is capable of simulating some of the fundamental features of the climate and hydrologic cycles in the earth's atmosphere. The potential usefulness of such a model for the study of hydrology and climatology on a global scale is discussed. (Woodard-USGS)
W71-02782

A STUDY OF THE ATMOSPHERIC HEAT AND MOISTURE BUDGET BETWEEN EQUATOR AND 60 DEG N DURING THE WINTER AND SUMMER SEASONS,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02B.
W71-02783

SOME MEASUREMENTS OF THE MERIDIONAL FLUX OF WATER VAPOR ACROSS 30 DEG N,
British Meteorological Office, Brackwell (England).
For primary bibliographic entry see Field 02B.
W71-02784

STUDY OF WATER BALANCE ELEMENTS OF FOREST AND FIELD WATERSHEDS,
State Hydrological Inst., Leningrad (USSR).
O. I. Krestovsky, and S. F. Fedorov.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 445-451, July 1970. 7 p, 1 fig, 16 ref.

Descriptors: *Water balance, *Watersheds (Basins), *Forests, *Cultivated lands, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Meteorology, Climatology, Vegetation, Precipitation (Atmospheric), Runoff, Surface waters, Groundwater, Soil moisture, Evaporation, Water storage, Evapotranspiration, International Hydrologic Decade.
Identifiers: USSR.

Relations between main elements of water balance of forest and field watersheds in the European part of the USSR are given according to scientific results obtained by the Valdai research hydrological laboratory. Water losses by evaporation are approximately equal in the forest and in the field, but forest stimulates the increase of precipitation and total runoff. (Woodard-USGS)
W71-02786

WATER BALANCE AND EARTH UNBALANCE,
Geological Survey, Lubbock, Tex.
T. E. A. van Hylckama.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 434-444, July 1970. 11 p, 5 fig, 2 tab, 35 ref.

Descriptors: *Water balance, *Earth (Planet), Hydrologic budget, Hydrologic cycle, Synoptic analysis, Meteorology, Climatology, Water storage, Soil moisture, Precipitation (Atmospheric), Land, Oceans, Atmospheric pressure, Equations, International Hydrological Decade.
Identifiers: *Earth's rotation effects.

Computations of the water balance of the world show that in March 6.6 x 10 to the 15th power kg more water is stored on land than there is in September. Most of this water occurs in the form of snow and soil moisture on the North American and North Eurasian continents. Observations made from tidal gage records show that there is 6 x 10 to the 15th power kg more water in the ocean in October than there is in March. The difference may be found in the air where, in September there is some 0.6 x 10 to the 15th power kg more water than in March. Winds, changes in atmospheric pressures, ocean currents, and annual shifts of moisture between land and sea cause a wobble in the axis of rotation. Hence, there is a variation in latitude as determined by astronomical observations, and the poles describe small ellipses with the mean diameter of about 6 meters. The components of the mean storage are presented together with the values of the excitation function in the two hemispheres due to the movement of the water over the earth's surface. (Woodard-USGS)
W71-02787

COMPARATIVE HEAT BALANCE CALCULATIONS - FIRST RESULTS OF A GLOBAL INVESTIGATION,
Bonn Univ., (Western Germany).
For primary bibliographic entry see Field 02B.
W71-02788

MERIDIONAL PROFILES OF THE NORTHERN HEMISPHERE WATER BALANCE,
Nevada Univ., Reno. Desert Research Inst.
C. K. Stidd.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 353-361, July 1970. 9 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Water balance, *Profiles, *Latitudinal studies, *Hydrologic cycle, Summer, Winter, Land, Oceans, Orography, Moisture, Meteorology, Precipitation (Atmospheric), Runoff, Evaporation, Water storage, Surface waters, International Hydrological Decade.
Identifiers: *Meridional profiles, *Northern hemisphere.

Starting with reasonable estimates of meridional profiles of atmospheric moisture transport, storage on land, runoff, and evaporation, water balances have been completed to yield profiles of ocean and land precipitation and atmospheric moisture transport between land and sea for winter and summer. Precipitation profiles from land are compared with those from the ocean to illustrate effects of orography and moisture limitations. Profiles of moisture exchange between land and sea suggest that land is the predominant moisture source during summer and that the atmospheric arm of the hydrologic cycle is reversed during this season. (Woodard-USGS)
W71-02789

WATER BALANCE IN ANGOLA FOR THE DECADE 1958/1968,
Carlos Quintela Gois.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 342-352, July 1970. 11 p, 3 fig, 4 tab.

Descriptors: *Water balance, *Synoptic analysis, *Foreign projects, International Hydrological Decade, Precipitation (Atmospheric), Flow rates, Meteorology, Hydrologic data, Hydrologic cycle, Hydrologic budget, Runoff, Streamflow, Water storage, Reservoirs.
Identifiers: *Angola (Africa).

Formulas relating precipitation with flow deficit for determining water balance in Angola (Africa) are presented. The water balance is examined in basins covering approximately 40% of the Province and the results obtained are extended to the remaining area. The total water balance is still calculated in basins draining to the Atlantic Ocean and neighboring countries. (Woodard-USGS)
W71-02790

DATA FOR THE STUDY OF THE WATER BALANCE IN SPAIN (IN FRENCH),
For primary bibliographic entry see Field 07C.
W71-02791

WATER RESOURCES AND WATER BALANCE OF THE USSR,
State Hydrological Inst., Leningrad (USSR).
A. P. Bochkov, A. I. Chebotarev, and K. P. Voskresensky.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 324-330, July 1970. 7 p, 6 ref.

Descriptors: *Water balance, *Water resources, *Synoptic analysis, Foreign projects, Surface waters, Mathematical studies, Equations, Meteorology, Hydrologic cycle, Hydrologic budget, Precipitation (Atmospheric), Vegetation, Runoff, Streamflow, Water storage, International Hydrological Decade.
Identifiers: *USSR.

Information on water balance, formation of water balance components, methods for water balance computation, and the amount of surface water in the USSR is presented. Total storage of fresh surface water of the USSR, on the basis of available data, slightly exceeds 45,000 cubic km; one half of it is in the Baikal Lake. The annual recharge of water (river runoff in the USSR) is about 10% of the total surface water storage of the Soviet Union. Its total amount and distribution is determined by peculiarities of climate, transfer of humid air masses from the ocean to the land, and the amount of precipitation and losses by evaporation. Topography and other geographical factors affect greatly the distribution of water resources over territory. (Woodard-USGS)
W71-02792

CATCHMENT EVAPORATION AS MANIFESTED IN CLIMATOLOGIC OBSERVATIONS,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Hydrologic Sciences Div.
For primary bibliographic entry see Field 02D.
W71-02793

MONTHLY WATER BALANCE IN TRIBUTARY WATERSHEDS OF THE GREAT LAKES SAINT LAWRENCE RIVER BASIN AS INFLUENCED BY CLIMATIC FACTORS,
Catholic Univ. of America, Washington, D.C. Dept. of Civil Engineering.
Boris S. Browzin.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 479-493, July 1970. 15 p, 7 fig, 4 tab, 6 ref.

Descriptors: *Water balance, *Great Lakes, *Climatic data, Monthly, Watersheds (Basins), Hydrologic budget, Hydrologic cycle, Mathematical studies, Equations, Hydrologic data, Meteorological data, Precipitation (Atmospheric), Runoff, Evaporation, International Hydrological Decade.
Identifiers: *St. Lawrence River basin.

The type of hydrology generated by tributarie
the Great Lakes and to the St. Lawrence Rive
the product of the climate dominating the tribu
watersheds which is best evident by studying s
watersheds. Four basins located in essentially
ferent climatic conditions were selected: two
snow-type hydrology, one in continental clim
and the other in oceanic. Two basins with plu
snow hydrology were selected. Calculation of
balance was made by determining three c
ponents independently: precipitation, runoff,
evaporation. The validity for this type of calc
tion was evaluated. Related graphs and table
data are presented. (Woodard-USGS)
W71-02795

**THE REGULARITIES OF LONG-TERM FL
TUATIONS OF STREAMFLOW AS A C
PONENT OF THE WATER BALANCE,**
S. N. Kritsky, and M. F. Menkel.
In: Symposium on World Water Balance, Vol 2
ternational Association of Scientific Hydro
Publication No 93, p 494-501, July 1970. 8 p,
17 ref.

Descriptors: *Water balance, *Synoptic ana
*Streamflow, *Flow rates, Hydrologic c
Hydrologic budget, International Hydrolo
Decade, Foreign projects.
Identifiers: *USSR.

Results of studying the regularities of fluctua
of water-balance components are discu
Emphasis is placed on streamflow fluctuation
long-term fluctuations studies, three prin
directions are traced: (a) investigations of dist
tion of streamflow values probability; (b) inves
tions of groupings of wet and dry years and stip
ing correlations; and (c) revealing cycles
trends in the process of hydrological phenom
(Woodard-USGS)
W71-02796

**HYDROLOGIC BUDGET OF NORTH AM
ICA AND SUB-REGIONS FORMULA
USING ATMOSPHERIC VAPOR FLUX DAT**
Connecticut Univ., Storrs. Dept. of Civil Engi
ing.
For primary bibliographic entry see Field 02B.
W71-02797

**DEVELOPMENT OF THE WA
RESOURCES AS A FUNCTION OF THE N
RAL RHYTHMICAL PHENOMENA,**
Akademiya Nauk SSSR, Leningrad.
A. V. Shnitnikov.
In: Symposium on World Water Balance, Vol
ternational Association of Scientific Hydr
Publication No 93, p 530-537, July 1970. 8 p,
14 ref.

Descriptors: *Water resources, *Earth (Pla
*Gravimetry, *Natural resources, Foreca
Hydrologic budget, Hydrologic cycle, Syn
analysis, Climatology, Meteorology, Water st
Precipitation (Atmospheric), Moisture, Int
tional Hydrological Decade, Foreign projects.
Identifiers: *Natural rhythmical phenor
USSR.

Contemporary conditions of global water reso
are related to the natural rhythmical phenome
the earth to predict water resources of the f
Along with rather intricate pictures of intera
rhythms in nature (climatic, geophysical, hydr
ical, etc. and biological--in the flora and f
there exist rhythms manifesting themselves
matically and distinctly. The rhythm of gr
tional force inequalities of somewhat less
2000 year period of duration is most represen
for the present. From basic trends of n
development of some major components
Northern Hemisphere continents, the
resources for the next one or two centuries ap
adverse. (Woodard-USGS)
W71-02798

TER BALANCE PECULIARITIES OF RST AREAS,
e Hydrological Inst., Leningrad (USSR).
primary bibliographic entry see Field 02F.
-02799

UAL WATER LOSSES IN THE CEYHAN IN, TURKEY,
eyin Conturk.
Proceedings of Central Treaty Organization inar on Evaluation of Water Resources With ce Data, March 4-8, 1969, Tehran, Iran, p 263- January 1970. 5 p, 1 tab, 8 ref.

criptors: *Water resources, *Water loss, *River ns, *Foreign projects, Runoff, Precipitation nospheric), Maps, Hydrologic data, Stream-, Watershed management.
tifiers: *Ceyhan River Basin (Turkey).

ual water losses over the Ceyhan Basin are cal-ted, utilizing the annual precipitation map and ff records. Results are presented in a map con-g of iso-lines of water loss in milimeters. With id of precipitation and water loss maps annual ff depths can be estimated in areas or sub-ns where direct information on runoff does not or is rather poor. Information presented on r losses may find a direct usage also, such as in uating climatic features. Since water loss, ther with precipitation and runoff, makes up water budget, the water loss map of the Ceyhan n can obtain a better usage when coordinated precipitation and runoff maps. (Woodward-S)
-02813

ESTIMATION OF FACTORS CONTROLLING STREAMFLOW IN AREAS WITH ITED DATA,
tute of Hydrology, Wallingford (England).
primary bibliographic entry see Field 02E.
-02818

PLICATION OF SOME EMPIRICAL THODS IN THE STUDY OF EVAPOTRANS-ATION IN IRAN,
tute of Hydro-Sciences and Water Resources hnology, Tehran (Iran).
primary bibliographic entry see Field 02D.
-02819

IMAL DATA GATHERING PROCEDURE,
t Pakistan Water and Power Development hority, Lahore.
primary bibliographic entry see Field 07A.
-02823

ALUATION OF WATER RESOURCES WITH RCE DATA.
tral Treaty Organization.

ceedings of Central Treaty Organization inar, March 4-8, 1969, Tehran, Iran, 1970. 501

criptors: *Water resources, *Hydrologic data, aluation, Surface waters, Groundwater, Water lity, Streamflow, Floods, Droughts, Watershed nagement, Water tables, Meteorological data, work design, Computers, Mathematical dels, Reviews, Dam design, Reservoir design, os, Hydrographs, Sedimentation.
ntifiers: *Scarce data, Project activities, Empiri-formulas, Probability curves.

s collection includes 33 papers that were sented at the Central Treaty Organization inar in Tehran, Iran, March 4 to 8, 1969. ntries represented on the program were Iran, istan, Turkey, United Kingdom, and the United tes. The reports are grouped into the following dings: Hydrological Characteristics of CENTO ntries; Data with Duration Limitation; Data h Aerial Limitation; and Data with Subject Limitation. Scarce data as applied to hydrological information can mean a degree of scarcity, as time passes new patterns of record will occur, trends will be noted and new extreme values will be obtained. Scarcity will continue because the record is always unfolding and as the length of record grows so the future predictions based upon it should become more precise. Many expedients are described in the papers to make scarce data applicable to the current problems. Emphasis is placed on mathematical analysis of scarce data and reviews for helping solve problems in water balance and watershed management. (Lang-USGS)
W71-02824

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 03B.
W71-02827

CLIMATES OF WEST PAKISTAN ACCORDING TO THORNTHWAITE'S SYSTEM OF CLASSIFICATION OF CLIMATES,
Nasrullah Khan.
Pakistan Geographical Review, Vol 23, No 1, p 12-36, January 1968. 12 fig, 1 tab, 7 ref.

Descriptors: *Arid lands, *Climatic zones, *Regional analysis, *Evapotranspiration, Planning, Mapping, Distribution patterns, Data collections, Evaluation, Precipitation (Atmospheric), Water analysis, Water demand, Water resources, Water supply, Water yield, Seasonal, Temperature, Classification, Surplus water, Moisture deficit, Climatic data, Humidity.
Identifiers: *West Pakistan, *Potential Evapotranspiration, *Thermal efficiency, *Climatic classification types.

Annual precipitation is variable and inadequate in West Pakistan and it is therefore important for planning purposes to estimate water need, water surplus and water deficits. Thornthwaite's climatic classification system has been adopted because it yields approximate values of potential evapotranspiration (PE), actual evapotranspiration, water surplus and water deficiency. Additionally, it is independent of vegetation zones, since only available precipitation and temperature data are needed. From calculated data, country-wide charts are presented of annual precipitation, annual and seasonal PE, annual water deficiencies and surpluses, moisture regions, thermal efficiency, seasonal variation of effective moisture and climatic types. In general the seasonal march of PE is uniform with low lying desert areas being the regions of lowest PE, and mountainous areas have the highest PE. Although evapotranspiration and precipitation are independent climatological events, the former is a function of both temperature and relative humidity. The PE of an arid region is therefore usually great because of a general lack of cooling and humidifying effects. Regional thermal efficiencies and climatic classification and the areas of seasonal or annual water deficits are described. (Casey-Arizona)
W71-02869

A PRACTICAL GUIDE TO WATER QUALITY STUDIES OF STREAMS,
Federal Water Quality Administration, Cincinnati, Ohio. National Field Investigations Center.
F. W. Kittrell.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $0.70. SOD No I67.8:ST8. Available at NTIS as PB-196 367, $0.95 in microfiche. Federal Water Pollution Control Administration Clean Water Report CWR-5, 1969. 135 p, 10 fig, 43 ref, append.

Descriptors: *Water quality, *Water analysis, *Analytical techniques, Streams, *Data collections, *Sampling, Methodology, Evaluation, Water pollution sources, Water supply, Water users, Chemical analysis, Biological properties, On-site tests, Laboratory tests, Data processing, Path of pollutants.
Identifiers: *Water quality studies, Report preparation.

A general guide for studying water quality of streams is presented. Specific procedures peculiar to stream pollution studies are dealt with at some length. General principles and techniques rather than exact methodology are covered. For example, various techniques are given by which time-of-water travel may be measured, rather than an exact description of dye-concentration measurement. Each chapter, except the last, is devoted to a single factor, principle or procedure involved in studies of water quality. One chapter, for example, deals with objectives of stream studies. It lists some of the reasons for conducting studies and discusses the importance of careful and thorough delineation of the objectives of a particular study before it starts. Another chapter has suggestions for preparation of a report on water quality. The last chapter suggests an orderly sequence for the conduct of stream studies. It attempts to wrap the essence of the preceding chapters in one package, without excessive repetition. The material is limited to information that is not ordinarily found in textbooks and technical articles. (Woodard-USGS)
W71-02885

OBSERVATIONS OF DEEP-WATER RENEWAL IN THE CARIBBEAN SEA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
Wilton Sturges.
Journal of Geophysical Research, Vol 75, No 36, p 7602-7610, December 20, 1970. 9 p, 6 fig, 15 ref.

Descriptors: *Mixing, *Sea water, *Currents (Water), Tides, Water circulation, Salinity, Water temperature, Current meters, Data collections.
Identifiers: *Caribbean Sea, *Venezuela basin.

Observations with bottom-moored current meters in the Jungfern passage show that deep water in the Venezuela basin in being renewed. During a 5-day record, the flow was mainly oscillatory at tidal frequency, with a net inflow by the tidal mechanism of only 6,000 cu m per sec. During a single 11-hour surge the inflow rate was 50 to 200 thousand cu m per sec. Steady-state heat-budget and oxygen-budget calculations require a renewal rate of about 100,000 cu m per sec. The sill depth is 1860 meters. Observations near the sill reveal a sharp interface between Caribbean water above and oceanic water below sill depth. The north-south hydrographic sections of IGY data show an abrupt change in vertical temperature gradient near 2600 to 2800 meters. This feature, also found in other basins, is interpreted to result from differences in renewal between tidal inflow and stronger sporadic surges, with the earth's rotation being an important controlling parameter. (Knapp-USGS)
W71-02897

METHODS FOR THE STUDY OF WATER BALANCE OF IRRIGATED LANDS AND IRRIGATION SYSTEMS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 03F.
W71-02910

OBJECTIVE STATISTICAL METHODS OF COMPUTATION AND GENERALIZATION OF THE PARAMETERS OF MAXIMUM RAINFALL RUNOFF,
State Hydrological Inst., Leningrad (USSR).
G. A. Alexeyev.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 114-127, 1969. 14 p, 4 tab, 4 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, *Reviews, Probability, Hydrograph analysis, Routing, Frequency analysis, Parametric hydrology, Statistical models, Analytical techniques.
Identifiers: USSR.

Because rain precipitation falls rather irregularly both in time and in space, statistical methods of analyzing rainfall-runoff relations are used in the USSR. These statistical methods are critically reviewed. Daily amounts of rainfall and amounts for ten-day periods are measured rather inaccurately by existing rain gage networks with a mean standard error of about 50-100%. Data on rainfall of certain exceedence probability may be obtained with reasonable reliability providing that they are averaged in time and space. (Knapp-USGS)
W71-02936

ON THE METHOD OF UNIT HYDROGRAPH AND MODELLING OF RAINFALL FLOODS BY ELECTRONIC ANALOGUE COMPUTERS,
State Hydrological Inst., Leningrad (USSR).
D. L. Sokolovsky.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 205-213, 1969. 9 p, 3 fig, 1 tab, 11 ref.

Descriptors: *Unit hydrographs, *Analog models, *Rainfall-runoff relationships, *Flood forecasting, Runoff forecasting, Model studies, Hydrograph analysis, Duration curves, Routing, Peak discharge, Discharge (Water).
Identifiers: Isochrone theory, Rainfall floods.

On the basis of the isochrone theory the method of unit hydrographs is used to solve some problems regarding unit-hydrograph elements depending on design time unit and rainfall duration. The method is applied to rivers with different catchment areas. In addition, the technique of electronic analog modelling machines for computation of rainfall flood hydrographs is discussed. The technique has shown the efficiency of modelling of floods of any kind and shape for different catchment areas with considerable speed and computation accuracy. (Knapp-USGS)
W71-02944

COMPUTATION PRINCIPLES OF FLOOD HYDROGRAPHS,
State Hydrological Inst., Leningrad (USSR).
K. P. Voskresensky.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 213-219, 1969. 7 p, 7 ref.

Descriptors: *Hydrograph analysis, *Flood forecasting, Rainfall-runoff relationships, Analog models, Unit hydrographs, Model studies, Floods, Discharge (Water), Peak discharge.
Identifiers: Flood hydrographs.

In practice while choosing a design flood hydrograph it is expedient to consider only the main elements of the flood wave shape: runoff volume, duration and maximum discharge. Modelling of a flood hydrograph can be performed as follows: (1) On the base of schematic geometric figures; (2) By means of type equation of flood wave; (3) On the basis of an actual flood selected from previously observed floods; (4) With the use of the averaged hydrograph of some typical floods for a given river; (5) On the basis of the unit hydrograph; (6) By means of the hydrograph of an analogous river; (7) On the basis of electrodynamic analogy. In selection of design hydrograph the following must be kept in mind: (1) The genetic conditions of flood formation (floods caused by rainfall, snowmelt, melting of glaciers and floods of mixed type); (2) The flood wave shape (with one or more crests) typical for a given river; (3) Flood origin (natural, artificial reservoir release, dambreak etc.). In addition account must be taken of the given limiting conditions such as maximum discharge or flood volume, the shortest duration at a given runoff volume etc. The optimum model is chosen depending on the particular problem, be it flood control or the passing of flood through hydraulic structures. (Knapp-USGS)
W71-02945

ANNOTATED BIBLIOGRAPHY OF REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
D. R. Baker, A. F. Flanders, and M. Fleming.
Available from NTIS as PB-194 072, $3.00 in paper copy, $0.95 in microfiche. Essa Technical Memorandum NESCTM10, July 1970. 28 p.
Identifiers: *Hydrology, *Bibliographies, *River basins, *Spaceborne photography, Meteorological satellites, Snow cover, Ice reporting, Remote sensing, Photogrammetry.

The objective of this program is to develop applications of satellite data to hydrologic problems confronting ESSA's mission. In the course of this activity considerable literature has been reviewed and the following annotated bibliography includes the 115 papers and reports deemed to be of importance to the program.
W71-02955

THE WATER ENCYCLOPEDIA.
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W71-03116

SPURIOUS CYCLES IN WATER RESOURCES SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W71-03124

2B. Precipitation

PRECIPITATION AND EVAPORATION-THEIR PRACTICAL AND OPERATIONAL ASPECTS FOR THE WATER CYCLE BALANCE,
World Meteorological Organization, Geneva (Switzerland). Div. of Hydrometeorology.
Jaromir Nemec.
In: Symposiim on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 193-199, July 1970. 7 p, 15 ref.

Descriptors: *International hydrological decade, *Reviews, *Water balance, *Precipitation (Atmospheric), *Evapotranspiration, Stations, Economics, Meteorology, Programs, Project planning.
Identifiers: *World Meteorological Organization.

The work of the World Meteorological Organization includes operational and practical activities connected with the assessment of precipitation and evaporation processes. These efforts are divided into four components: international standardization and intercomparison of instruments and methods of observation, use of advanced technology for monitoring of data in the WMO system of the World Weather Watch, technical assistance to developing countries in water balances of their catchments and guidance on operational techniques of water balance calculation. (Knapp-USGS)
W71-02775

ESTIMATION OF PRECIPITATION AS WATER BALANCE ELENENT,
State Hydrological Inst., Leningrad (USSR); and Main Geophysical Observatory, Leningrad (USSR).
A. P. Bochkov, and L. R. Struzer.
In: Symposium on World Water Balance, Vol 1 ternational Association of Scientific Hydrol Publication No 92, p 186-193, July 1970. 8 p ref.

Descriptors: *Precipitation gages, *Rain ga *Calibrations, *Instrumentation, Sampling, Wi Gaging stations, Rainfall disposition.
Identifiers: USSR.

Precipitation gages underestimate precipita because of wind influence, losses of precipita on moistening of the raingage bucket, and evap tion. In 1961 the Hydrometeorological Servic the USSR started experimental study of the er of various standard precipitation gages. greatest errors and the most difficult to estir appeared to be the errors caused by the wind fect. From the physical point of view it is clear the value of the error depends on the wind spee the height of the receiver and on the precipita structure (the size of raindrops and snow-flak Systematic errors of simple pit raingages, inclu the effects of splashing, do not exceed 1.5%. On basis of investigations of precipitation meas ment errors a system of correcting long-t average monthly, seasonal and annual precipita values, precipitation values of individual mon and measured precipitation values for observa terms on meteorological stations and posts developed. (Knapp-USGS)
W71-02776

ON THE QUESTIONS OF RAINFALL M SUREMENT AND REPRESENTATIVENESS,
Hydrological Research Unit, Wallingford gland).
John C. Rodda.
In: Symposium on World Water Balance, Vol ternational Association of Scientific Hydro Publication No 92, p 173-186, July 1970. 14 fig, 4 tab, 34 ref.

Descriptors: *Rain gages, *Calibrations, *In mentation, Network design, Sampling, Preci tion gages, Winds, Gaging stations, Rainfall dis tion.
Identifiers: United Kingdom.

Conventional types of raingage, with ori between 30.5 cm and 2 m above ground l suffer from several sources of error, chiefly w These combine to make the catch of a gage s matically less than the quantity of rain that w otherwise reach the ground in the absence of gage. Errors resulting from evaporation, splash and similar causes are usually minimized by design of the gage, but no gage yet constru overcomes the effect of the wind. Its influenc be lessened, however, by the use of shields walls, and similar devices, but the most satisfa way of mitigating the effect of wind is to insta gage in a pit with its rim at ground level, cov the pit with a splash-inhibiting surface. Re from ground level raingages are being collecte number of sites in the United Kingdom. In s wind-swept basins, raingages installed level the ground produce the more realistic representative measurements than elevated g For these conditions a single weekly gage ma adequate to sample areas 1 km across. (Kn USGS)
W71-02777

SIMULATION OF THE HYDROLOGIC CY OF THE GLOBAL ATMOSPHERIC CIRC TION BY A MATHEMATICAL MODEL,
Environmental Science Services Administra N. J., Geophysical Fluid Dynamics Lab.
For primary bibliographic entry see Field 02A
W71-02782

A STUDY OF THE ATMOSPHERIC HEAT MOISTURE BUDGET BETWEEN EQUA AND 60 DEG N DURING THE WINTER SUMMER SEASONS,
Wisconsin Univ., Madison.

an Hastenrath.
Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology lication No 93, p 415-421, July 1970. 7 p, 4 9 ref.

criptors: *Heat budget, *Water vapor, *Atphere, *Latitudinal studies, *Synoptic analysis, ter, Summer, Hydrologic cycle, Climatic data, eorological data, Equations, Latent heat, potranspiration, International Hydrological ade.
tifiers: *Meridional circulation, *Equator to legrees N, Troposphere, Sensible heat, Potenal energy.

he basis of seasonal mean data, the divergence e flux of latent heat, potential energy, andsen- heat is computed for the layer 1000-100 mb 10 deg latitude belts between Equator and 60 N. The magnitude of latitude-mean otranspiration resulting from the latent heat get is realistic. Similarly, the budget of sensible and potential energy for the entire troposphercolumn is compared with latitude-mean esties of diabatic heat sources and sinks available he literature. Within the tropics, the mean idional circulation is the major agent for the idional transport of heat and moisture. odard-USGS)
1-02783

IE MEASUREMENTS OF THE RIDIONAL FLUX OF WATER VAPOR ROSS 30 DEG N,
ish Meteorological Office, Brackwell (End).
lurray.
Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology lication No 93, p 376-386, July 1970. 11 p, 4 l tab, 10 ref.

criptors: *Water vapor, *Measurement, titudinal studies, *Atmosphere, *Synoptic ysis, Moisture, Climatic data, Meteorological , Hydrologic data, Equations, Monsoons, Ed-, Climatic zones, Summer, Winter, Land, ans, Moisture content, Circulation, Internaal Hydrological Decade.
tifiers: Thirtieth parallel N, *Aerological cross-ions.

nputations of meridional transport of water or across 30 deg N were made for March, June, tember and December 1958, based on data exted from daily aerological cross-sections. In all nths the total flux of moisture is directed hwards. In summer the flux is about twice as t as in winter. Seasonal difference in total flux ears to be mainly due to contributions from ding eddy flux of moisture associated with mer monsoons. The transient eddy flux of sture, associated with synoptic-scale rbance, is greater in winter than in summer. transient eddy flux is directed northwards in all nths. The mean circulation flux associated with tropical Hadley cell is generally about the same nitude as other components but directed equaards. Seasonal changes in position and intensif main concentrations of meridional transport ater vapor are discussed. (Woodard-USGS)
1-02784

MPARATIVE HEAT BALANCE CALCULANS - FIRST RESULTS OF A GLOBAL INSTIGATION,
n Univ., (Western Germany).
lenning.
Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology lication No 93, p 361-376, July 1970. 16 p, 5 14 ref, append.

criptors: *Heat balance, *Water balance, titudinal studies, *Earth (Planet), Hydrologic , Equations, Hydrologic cycle, Meterology, cipitation (Atmospheric), Climatic data, Meteorological data, Air temperature, Humidity, Vapor pressure, Cloud cover, Solar radiation, Oceans, Orography, International Hydrological Decade.

Climatological data, including cloud cover and humidity, are evaluated by three methods in determining the global balances of heat and water. Emphasis is on the method of the late German meteorologist, Fritz Albrecht, who published data on global heat and water balance figures for oceans and continents. His results concerning the ocean, processed into time latitude cross-sections, and computations of the budget terms for North America and Northern Asia are presented. Five essential zones of evaporation minus precipitation are distinguished year round above the ocean. The meridional gradient of this quantity is twice as strong above the northern as above the southern hemisphere ocean. (Woodard-USGS)
W71-02788

MERIDIONAL PROFILES OF THE NORTHERN HEMISPHERE WATER BALANCE,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 02A.
W71-02789

WATER BALANCE IN ANGOLA FOR THE DECADE 1958/1968,
For primary bibliographic entry see Field 02A.
W71-02790

MONTHLY WATER BALANCE IN TRIBUTARY WATERSHEDS OF THE GREAT LAKES SAINT LAWRENCE RIVER BASIN AS INFLUENCED BY CLIMATIC FACTORS,
Catholic Univ. of America, Washington, D.C. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-02795

HYDROLOGIC BUDGET OF NORTH AMERICA AND SUB-REGIONS FORMULATED USING ATMOSPHERIC VAPOR FLUX DATA,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
G. P. Malhotra, and P. Bock.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 501-524, July 170. 24 p, 14 fig, 4 tab, 25 ref.

Descriptors: *Hydrologic budget, *Water vapor, *Atmosphere, *Water balance, Hydrologic cycle, Hydrologic data, Climatic data, Meteorological data, Precipitation (Atmospheric), Evapotranspiration, Surface waters, Groundwater, Water storage, Equations, International Hydrological Decade.
Identifiers: *North America, *Subregions.

The atmospheric water vapor flux divergence has been computed to obtain water balances of parts of North America for the period May 1, 1958 to April 30, 1963. Eleven areas were studied ranging in size from 8.5 million square kilometers (3.3 million square miles) to 150,000 square kilometers (58,000 square miles). The data included mean-monthly vertically-integrated distribution of flux divergence and precipitable water, regional averages of runoff, and isohyetal averages of precipitation. The atmospheric data were used to estimate the mean difference between precipitation and evapotranspiration. These values further yielded values of mean monthly evapotranspiration, and indirectly yielded mean monthly change in the surface and subsurface water storage, and the yearly pattern of the cumulative storage. The results of the study indicate that the patterns of monthly evapotranspiration and storage as computed from atmospheric data become questionable if the size of area is reduced below about 550,000 square kilometers (200,000 square miles). (Woodard-USGS)
W71-02797

MAXIMUM ONE DAY FALLS OF PRECIPITATION IN TEHRAN,
United Nations Development Program, Tehran (Iran).
A. H. Gordon, and J. G. Lockwood.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 467-470, January 1970. 4 p, 2 tab, 2 ref.

Descriptors: *Precipitation (Atmospheric), *Forecasting, *Hydrologic data, *Statistical methods, *Foreign projects, Equations, Topography, Floods, Mountains, Planning.
Identifiers: *Tehran (Iran), Seasonal precipitation, Historic records.

Certain parts of Tehran are vulnerable to flooding when the drainage facilities are overtaxed with excessive runoff from higher slopes. The winter precipitation may be largely snow, particularly in the mountains behind Tehran. The runoff will therefore be slow. In spring the freezing level may be much higher and there is a danger of rapid runoff and floods. Rainfall data since 1898 are used with related factors for analysis of maximum one-day precipitation falls. Factors considered include mean monthly precipitation; monthly median for maximum one-day falls; records of the maximum rainfall in one day for winter and spring respectively; rainfall values likely to be equalled or exceeded in given return period during winter and spring; mean annual precipitation; and, relation between elevation and rainfall. Mean annual precipitation for the city is about 200 mm, but much larger amounts occur over the Elburz mountains to the north and bare slopes are conductive to rapid runoff and periodic flooding. (Woodard-USGS)
W71-02801

A STATISTICAL ANALYSIS OF THE ANNUAL, MONTHLY AND DAILY PRECIPITATION OF TEHRAN,
Fereidoon Hashemi.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 439-466, January 1970. 28 p, 5 fig, 10 tab, 2 ref.

Descriptors: *Precipitation (Atmospheric), *Forecasting, *Statistical methods, *Foreign projects, Equations, Probability, Hydrographs, Annual, Monthly.
Identifiers: *Tehran (Iran), *Historic data, Cumulative probabilities, Daily rainfall records.

Methods of statistical analysis of the precipitation record of Tehran, Iran (35 deg 41'N latitude and 51 deg 19'E longitude) are presented along with the resulting tables and graphs on the probabilities of annual, monthly and daily precipitation. Precipitation was analyzed as a whole and no attempt was made to break it down into snow, ice, and rain. Daily precipitation records of Tehran from 1898 through 1967 were used in this project. Computations indicate that the annual precipitation follows the Gaussian distribution with 99% certainty. The largest portion occurs in the November to April period during which time 81% of the total precipitation occurs. Probability of receiving more than 35 mm in a single day is never more than 5%. This amount over a 24 hour period does not cause flood damage. (Woodard-USGS)
W71-02802

RAINFALL FREQUENCY ATLAS OF TURKEY,
State Hydraulics Works, Ankara (Turkey). Hydrology Section.
Samim Oztek.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 167-169, January 1970. 3 p, 2 fig, 8 ref.

Descriptors: *Rainfall, *Frequency analysis, Rain gages, Probability, Statistical methods, Distribution patterns, Maps, Foreign projects.
Identifiers: *Hydrologic Atlas, *Turkey.

Frequency analysis of approximately 500 point rainfall values having 10 or more years record were used in the preparation of this Atlas. Rainfall-frequency data cover durations from 1 hour to 24 hours and return periods from 2.33 to 100 years. Methods used in compiling data are described. Data and locations of stations are plotted on a 1:2 250,000 scale map of Turkey. (Woodard-USGS)
W71-02820

THE DROUGHTS OF ANTIGUA,
Halcrow (William) and Partners, London (England).
For primary bibliographic entry see Field 02E.
W71-02822

MERCURY IN THE ATMOSPHERE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02894

ATMOSPHERIC AND FLUVIAL TRANSPORT OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02895

TRITIUM FALLOUT IN THE PACIFIC UNITED STATES,
California Univ., Los Angeles. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-02898

TRITIUM PROFILE AT THE NORTH PACIFIC (1969) GEOSECS INTERCALIBRATION STATION,
For primary bibliographic entry see Field 02K.
W71-02900

SIGNIFICANCE OF CAMILLE (1969),
Florida State Univ., Tallahassee. Dept. of Geology.
William F. Tanner.
Southeastern Geology, Vol 12, No 2, p 95-103, November 1970. 9 p, 1 fig, 15 ref.

Descriptors: *Hurricanes, *Florida, *Damages, *Waves (Water), Floods, Wind velocity, Beach erosion, Beaches, Gulf of Mexico, Mississippi, Sea walls, Coasts, Shore protection.
Identifiers: *Hurricane Camile (1969).

Hurricane Camille (1969) crossed the Mississippi-Louisiana coast as the most destructive tropical storm ever to strike the United States mainland. Because of the shape of the coast and the wind pattern destructive waves could come only from the east. Most of the damage was done by waves advancing toward the west. The maximum surface wind velocity was close to 265 km/hr, the storm tide was 6 to 7 meters, and the probable maximum wave height was about 10 meters above still water. Despite the large destruction of coastal property, the mainland beach and sea-wall were damaged little or not at all. This may have been due to the fact that the pre-storm nearshore slope of the bottom was only about two m/km. Camille built no mainland beach ridges. A comparison of probable tide heights from several hurricanes indicates that Camille may have been the 20 to 70 year storm for the entire northern Gulf coast, or the 80 to 160 year storm for the Mississippi segment. (Knapp-USGS)
W71-02908

DESIGN RAINFALL CHARACTERISTICS OF THE USSR TERRITORY,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02935

OBJECTIVE STATISTICAL METHODS OF COMPUTATION AND GENERALIZATION OF THE PARAMETERS OF MAXIMUM RAINFALL RUNOFF,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02936

AGROCLIMATOLOGICAL STUDIES IN THE LEVANT,
Swedish Meteorological and Hydrological Inst., Stockholm.
C. C. Wallen.
Technical Report on a Study of Agroclimatology in Semi-arid and Arid Zones of the Near East. WMO Technical Note No 56. Agroclimatological Methods: Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 225-233, UNESCO, 1968. 2 tab.

Descriptors: *Data collections, *Climatic zones, *Rainfall, *Evapotranspiration, *Dry farming, Regional analysis, Variability, Weather data, Temperature, Statistical methods, Arid climates, Semiarid climates, Environmental effects, Probability, Water balance, Altitude, Agronomy, Cultivation, Agriculture.
Identifiers: *Middle East, *Potential evapotranspiration, *Agroclimatology, *Climatic classification, Lebanon, Syria, Jordan, Iran, Iraq.

A pilot study was made to investigate basic climatic conditions for agriculture in Lebanon, Syria, Jordan, Iraq and Iran. Semiarid lands of the area are used for cereal and stock-raising and arid lands for stock-raising. Due to population pressures, good pastoral lands are being cultivated for cereal production with resulting declines in soil structure. Climatic classification was initially determined by classical methods using rainfall and temperature data. The limit for dry land farming is about 240 mm average annual rainfall with a 37 percent interannual variability, which corresponds to the border-line between arid and semiarid zones. The length of the season of reliable rainfall is also considered an important aridity condition. Although it is not a limiting factor in the region, temperature was used to classify 12 subregions because it is a dominant factor in type and variety of crop selection. Potential evapotranspiration (ETP) calculated from Penman's formula and estimated actual evapotranspiration were used to determine the true water balances. Comparing the classical and water balance approaches, 2 important conclusions emerged. (1) In large areas of similar ETP and soil conditions the degree of aridity is largely maintained by the amount and variability of rainfall. (2) The radiation term is more important than the aerodynamic term of Penman's formula. Temperature, rainfall, water balance and agricultural conditions are fairly homogeneous for each of the 12 subregions. (Casey-Arizona)
W71-02971

FAO/UNESCO/WMO AGROCLIMATOLOGY SURVEY OF A SEMI-ARID AREA IN WEST AFRICA SOUTH OF THE SAHARA,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
J. Cocheme.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 235-248, UNESCO, 1968.

Descriptors: *Rainfall, *Climatic zones, *Semiarid climates, *Data collections, *Evapotranspiration, Climatology, Ecotypes, Crops, Gradation, Environmental effects, Vegetation effects, Soil types, Variability, Isohyets, Temperature, Water balance, Drought resistance, Plant growth, Cotton, Soil moisture, Dry farming, Statistical methods, Photoperiodism, Growth rates, Cultivation, Sorghum, Fertility, Hydrologic budget, Maps, Histograms, Surveys, Moisture availability, Seasonal, Regional analysis.
Identifiers: *Africa, *Potential evapotranspiration, *Agroclimatology, *Reflection coefficient, Millet.

An agroclimatic analysis was made of a zone sub-Saharan Africa between the Atlantic Oce and the Chad-Sudan boundary, which is border on the north by desert and the south by hum savannah and forest. There is, therefore, a nor south gradient of steadily decreasing aridity. So radiation is constant and high, and summer ra peak in August. The climatic zonation is reflect in vegetative and edaphic zonation. The agricultu of the area separates cultivation and anim busbandry, and soil fertility is restored by natu fallow. Little or no use is made of intensificati techniques. Improvements are planned on a lar scale and therefore basic information on the e vironments is essential. Rainfall histograms a isohyets were constructed. There is little variati in rainfall day and therefore north-south gradie reflect increases in the number of rainy da Potential evapotranspiration (E sub T) was cal lated according to Penman's formula using a refl tion coefficient of 0.25, and was also distribu zonally. Two maxima and 2 minima occur yea with consequences for crop production. The du tion and dates of occurrence of availability of wa were determined at various levels of E sub T. number of examples are given illustrating how e type adaptation to climate can be gauged by co paring climatic parameters with plant biologi characteristics. (Casey-Arizona)
W71-02972

RAINFALL DISTRIBUTIONS AND SIMUL TION MODELS,
University of New England, Armidale (Australia
B. J. Phillips.
Australian and New Zealand Assoc For The A vancement of Sci, 41st Congress - Adelaide, A 1969. Section 8 - Mathematical Sciences. 26 p fig, 8 tab, 15 ref. 3 append.

Descriptors: *Simulation analysis, *Comput *Rainfall, *Stochastic processes, Farm mana ment, Time.
Identifiers: Historical records, Pearson curve an sis.

The basic aim was to investigate ways in wh rainfall can be incorporated into simula models. It was concerned essentially w stochastic specification of rainfall and was orie particularly towards the generation of data for f management decision problems. The gen question of rainfall patterns was considered and to an investigation of autocorrelations in an tempt to define a time period beyond which the curence of rainfall can be considered a rand process. Simulation of such processes based u historical data and based on the fitting of proba ty density functions were looked at and sugge ways in which these functions could be in porated into simulation models were given. E attention was given to the problem of genera rainfall patterns, and some tentative methods w suggested. Curves for quarterly rainfall data w written for an IBM 1620 computer to evaluate dinates of the three types of Pearson curves a sis used. Simulation was viewed as a forward-l ing process which had as its aim assisting the a sis of complex decision problems. The histo data used for estimation in the empirical port of this paper consisted of 91 years' records f the Armidale recording station. (Kriss-Cornell)
W71-03071

CLOUDS AND PRECIPITATION IN TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geoscie and Texas Univ., Austin. Atmospheric Sci Group.
Donald R. Haragan, and Kenneth H. Jehn.
Water Resources Bulletin, Vol 6, No 6, p 893- November-December 1970. 14 p, 7 fig, 6 tab, Tex Water Dev Bd Grant IAC (68-69)-175

Descriptors: *Precipitation (Atmosph *Synoptic analysis, *Texas, *Water supply, matology, Weather, Meteorological

leteorology, Weather data, Weather modification, Clouds.
lentifiers: *High Plains (Texas).

study of the relationship among cloudiness, recipitable water vapor, stability and precipitation presented for the Texas High Plains. During eriods of above-normal rainfall, precipitation dur- g late fall and winter is associated with stratifica- on clouds which develop in conjunction with yclonic activity. Spring and summer precipitation most highly correlated with cumuliform clouds haracteristic of convective activity. Wet periods e further characterized by atmospheric instability id above-normal amounts of precipitable water apor and water-vapor flux. Dry periods are as- ociated with atmospheric circulation patterns hich either serve to cut off the supply of low-level oisture, produce subsidence and consequent at- ospheric stability, or both. (Knapp-USGS)
71-03128

C. Snow, Ice, and Frost

ARBON DIOXIDE IN THE SURFACE WATER F THE ICE-COVERED BERING SEA,
laska Univ., College. Inst. of Marine Science.
or primary bibliographic entry see Field 02K.
71-03115

OSITION OF PERMAFROST BENEATH MALL WATERCOURSES,
old Regions Research and Engineering Lab., anover, N.H.
u. V. Dmitriyev.
vailable from NTIS as AD-711 929, $3.00 in aper copy, $0.95 in microfiche. Translation from laterialy VIII Vsesoyuznogo Mezhduvedomstven- ogo Soveshchaniya Po Geokrilogiye, No 2, 1966.
lentifiers: *Permafrost, Measurement, *Rivers, land waterways, Temperature, Soil mechanics, lay, Silt, Moisture, Thickness, Construction, SSR, Translations, Boreholes.

aking into account the contradictory nature of ex- ting points of view and the conclusions drawn oncerning the position of permafrost beneath mall watercourses, in the region of layout of the Iz- estkovaya-Urga-Chegdomyn (southern zone of issemination of permafrost in the Far East) a tudy was made of 50 small watercourses, both per- anent and ephemeral, as well as runoff zones and ater-intake canals. Data for more than 150 sta- ons were considered. Computation formulas are roposed for determining the maximum depth of he upper permafrost boundary in places where atercourses flow.
71-03190

N THE MECHANISM OF NIVAL PROCESSES,
old Regions Research and Engineering Lab., lanover, N.H.
. P. Lyubimov.
ranslation of: Podzemnyy Led, Part III, No 3, p 58-175, 1967. Available from NTIS as AD-711 79, $3.00 in paper copy, $0.95 in microfiche. RREL Translation, 1970. 14 p, 5 fig, 9 ref.
dentifiers: *Snow, *Erosion, Freezing, Permafrost, Melting, Deposits, Penetration, Frost heave, Rock Geology), Transport properties, Terrain, USSR, Translations, *Nival processes, Geomorphology, lopes.

he 'nivation' concept ('nivation' from the Latin oot 'nix' — snow) is understood as the eomorphological process of the formation of cor- ie-like recesses on the slopes in the places of oc- urrence of firms as a result of the disruption of ocks along the edges of the firms under the effect f physical erosion and the subsequent removal of he material with the aid of fine streams of melt- vater. The first combines the processes of disrup- ion in continuity of the rocks and the active reparation of the material for displacement. The irst group includes the following processes: (1) microclimatic: the development of a low-temperature zone under the firm, with the retention of a layer of seasonally frozen ground and the upheaval of the cover of ever-frozen rocks. The second group of the processes combines the processes of transporting and depositing the material; as a result, we have the formation of nival deposits and nival relief forms.
W71-03192

2D. Evaporation and Transpiration

MAPPING POTENTIAL EVAPORATION FOR TROPICAL EAST AFRICA: THE ACCURACY OF PENMAN ESTIMATES DERIVED FROM INDIRECT ASSESSMENTS OF RADIATION AND WIND SPEED,
East African Agriculture and Forestry Research Organization, Muguga (Kenya).
T. Woodhead.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 232-241, July 1970. 10 p, 2 tab, 15 ref.

Descriptors: *Evapotranspiration, *Meteorology, Data collections, Synoptic analysis, Clouds, Winds, Humidity, Meteorological data, Evaporation, Tropical regions, Solar radiation.
Identifiers: *Potential evaporation, Penman method, East Africa, Ugnada, Kenya, Tanzania.

In tropical East Africa, the largest contribution to the Penman estimate of potential evaporation is from the short-wave radiation term. Insolation is measured at some sites, but large areas are devoid of radiation-measuring stations. Within some of these areas there are civil airfields at which meteorological observers do record cloud amount, from which insolation estimates have been deduced. In evaluating the aerodynamic term, an approximate relationship between daily wind run and synoptic Beaufort-scale wind speeds has been established. Using these cloud and wind speed data, potential evaporation totals for an individual month or year may be respectively evaluated with errors of 18 and 15%; at stations equipped with pyrheliometers and recording anemometers, the corresponding error is 6.5%. Long-term mean potential evaporation rates, monthly and annual, may each be determined to within 15% from a twenty-year series of synoptic cloud and wind observations. Such estimates, although inaccurate, are of value to hydrologists and agriculturists when no other evaporation data are available. (Knapp-USGS)
W71-02771

METHODS FOR THE ESTIMATION OF EVAPORATION FROM LAND, APPLIED IN THE USSR,
State Hydrological Inst., Leningrad (USSR).
P. P. Kuzmin.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 225-231, July 1970. 7 p, 12 ref.

Descriptors: *Water balance, *Evaporation, Heat budget, Hydrologic budget, Winds, Diffusion, Evapotranspiration, Air temperature, Humidity, Data collections, Data processing, Lysimeters, Runoff, Inflow, Soil water, Soil water movement.
Identifiers: USSR.

Climatological and balance methods used for estimation of evaporation from land, snowpack and swamps applied in the USSR are reviewed. Balance methods are based on detailed study of water and heat components. They are accurate enough, but seldom used. Climatological methods proceed from simplified computation schemes based on the plotting of empirical relations and the usage of data of standard meteorological observations from hydrometeorological stations. The method of turbulent diffusion, which is also known as the method of gradient observations, has both a theoretical and an empirical basis. The principle of turbulent diffusion method consists in the recording of the vapor flux directed vertically from the evaporating surface. The basic material for the determination of the coefficient of turbulent exchange and of other parameters of the computation scheme is the measurement data on vertical gradient of wind speed, air temperature and humidity above the evaporating surface. (Knapp-USGS)
W71-02772

THE PREDICTION OF ACTUAL EVAPORATION IN SEMI-ARID AREAS,
Hydrological Research Unit, Wallingford (England).
J. V. Sutcliffe, and C. H. Swan.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 213-224, July 1970. 12 p, 5 fig, 3 tab, 7 ref.

Descriptors: *Water balance, *Arid lands, *Rainfall-runoff relationships, *Evapotranspiration, *Vegetation effects, Soil water, Infiltration, Forests, Mapping, Rainfall, Runoff, Hydrologic budget, Precipitation (Atmospheric).
Identifiers: *Iran.

It is essential to consider the role of the soil moisture regime in dividing rainfall between actual evaporation and runoff in arid lands. The dangers of the simple comparison of rainfall and potential evaporation are illustrated by comparing the two sides of the Alborz range in Iran. The southern slopes receive moderate winter precipitation but because of this seasonal distribution the actual evaporation is low compared with the high annual potential evaporation; the runoff is relatively high. The northern slopes facing the Caspian Sea receive summer rainfall as well but the actual evaporation is high and the runoff low. The cause of this apparently anomalous situation is the forest on the Caspian slopes which transpires at the potential rate where the perennial rainfall allows it to survive. A study which took account of the limited soil moisture storage and the seasonal precipitation pattern would predict this result at least in qualitative terms. While global and regional rainfall maps, together with maps of potential evaporation, are an essential first step towards a gter balance, any realistic study must take account of the existing information on regional runoff, soil depths, and vegetation. (Knapp-USGS)
W71-02773

ESTIMATION AND MAPPING OF EVAPORATION,
British Meteorological Office, Bracknell (England).
J. Grindley.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 200-213, July 1970. 14 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Evaporation, *Evapotranspiration, Hydrologic budget, Water balance, Meteorology, Soil moisture, Soil water, Mapping, Land use, Networks.
Identifiers: *Potential evaporation, Penman method, United Kingdom, England, Wales.

Most evaporation data in the United Kingdom are obtained using the Penman formula, which permits calculations of potential evaporation. By making assumptions about the way in which actual evaporation falls below the potential as soil moisture becomes limiting, it is possible to calculate and map soil moisture deficit. Careful assessment of land use permits an assessment of actual evaporation and soil moisture deficit over any specific catchment area for use in water balance studies. A provisional map of potential evaporation was prepared for England and Wales and a map of actual evaporation is being prepared using a 10 km network of grid intersections with an appropriate

spectrum of land use for each intersection. (Knapp-USGS)
W71-02774

PRECIPITATION AND EVAPORATION-THEIR PRACTICAL AND OPERATIONAL ASPECTS FOR THE WATER CYCLE BALANCE,
World Meteorological Organization, Geneva (Switzerland). Div. of Hydrometeorology.
For primary bibliographic entry see Field 02B.
W71-02775

EXPERIMENTAL INVESTIGATIONS AND COMPUTATION OF EVAPORATION FROM WATER SURFACE,
State Hydrological Inst., Leningrad (USSR).
V. I. Kuznetsov.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 153-160, July 1970. 8 p, 2 fig, 2 tab, 12 ref.

Descriptors: *Evapotranspiration, *Water balance, *Evaporation, Soil moisture, Lakes, Instrumentation, Evaportranspiration control, Hydrologic cycle, Lysimeters, Evaporation pans, Monomolecular films.
Identifiers: USSR.

A brief description is presented of investigations of evaporation from water surface in the USSR. Standard instruments, methods for measurement and computation of evaporation are described. Measurements of evaporation from free water surface on the USSR network stations are performed by means of 20 sq m evaporation tanks, 2 m deep, and evaporimeters (GGI-3000) which are either installed in soil on continental evaporation plots or on special rafts on lakes and reservoirs. The USSR evaporation network comprises approximately 490 observation points, of which 55 are equipped with evaporation tanks and evaporimeters, while the rest have only evaporimeters. This network includes about 30 floating evaporation installations. The influence of vegetation growth in lakes and reservoirs on evaporation, evaporation from turbid, mineralized and polluted water, the reduction of evaporation from water surfaces covered by oil and monomolecular films, and other factors are also studied. (Knapp-USGS)
W71-02779

WATER BALANCE OF SWAMPS AND ITS COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02785

CATCHMENT EVAPORATION AS MANIFESTED IN CLIMATOLOGIC OBSERVATIONS,
Dept. of Energy, Mines and Resources, Ottawa (Ontario). Hydrologic Sciences Div.
F. I. Morton.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 421-433, July 1970. 13 p, 2 fig, 1 tab, 14 ref.

Descriptors: *Evaporation, *River basins, *Model studies, Hydrologic data, Climatic data, Meteorological data, Soil moisture, Vegetation, Precipitation (Atmospheric), Runoff, Equations, Evapotranspiration, Humidity, Air temperature, Solar radiation, International Hydrological Decade.
Identifiers: *Canada, *Ireland.

When evaporation from a large area is limited by the moisture supply, there are changes in heat content and water vapor content of the lower atmosphere. Therefore, potential evaporation, which is effected by temperature and humidity of the bottom layer of air, may be regarded as a manifestation of regional evaporation. This permits the formulation of an equation in which the sum of regional and potential evaporation is equal to the evaporation equivalent of the absorbed global radiation so that regional evaporation, a product of climatic, soil moisture and vegetative processes, may be estimated by its effects on climatologic observations. The resultant model is tested with hydrologic and climatologic data from 20 river catchments in Canada and Ireland, representing a range in annual runoff of approximately zero to one meter and a range of snow cover duration of approximately zero to six months. Comparison of model predictions with precipitation less runoff estimates over five-year periods provides good evidence for the validity of the model and interesting insights into the seasonal variability of catchment storage. (Woodard-USGS)
W71-02793

APPLICATION OF SOME EMPIRICAL METHODS IN THE STUDY OF EVAPOTRANSPIRATION IN IRAN,
Institute of Hydro-Sciences and Water Resources Technology, Tehran (Iran).
M. Mozayeni.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 181-194, January 1970. 14 p, 7 fig, 3 tab.

Descriptors: *Water resources, *Evapotranspiration, *Streamflow, *River basins, Hydrologic data, Air temperature, Humidity, Precipitation (Atmospheric), Atmospheric pressure, Solar radiation, Equations, Water loss, Methodology, Water balance.
Identifiers: *Iran, *Scarce data, Empirical formulas, Theoretical formulas.

Some quantitative results are described of application of empirical and theoretical methods to estimating evapotranspiration in several regions of different climatic conditions in Iran. The three major climatic zones are Caspian Littoral, Plateau and foothills, and the Southern Coastal plain. Whereas the annual average precipitation in Iran is about 250 mm, the potential evaporation is almost 10 times that amount. Potential evapotranspiration may be estimated by the Penman, Turc or Thornthwaite methods. The Penman method is more appropriate for plains in the Central Plateau having continental climate with high radiation and moderate temperature. The Thornthwaite method is not applicable to the Plateau but is appropriate for the Caspian Sea coastal region. Data are lacking for direct measurements by lysimeters and for solar radiation. An experimental catchment 60 sq km in area is being set up in Iran to determine the water balance and other parameters as part of the International Hydrological Decade. (Lang-USGS)
W71-02819

SPRING EVAPOTRANSPIRATION FROM LOW SAGEBRUSH RANGE IN SOUTHERN IDAHO,
Idaho Univ., Moscow. Water Resources Research Inst.
George H. Belt, Jr.
Available from NTIS as PB-196 349, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, University of Idaho, Water Resources Research Institute, Moscow, Idaho, October 1970. 44 p, 16 fig, 6 tab, 7 ref. OWRR Project A-014-IDA (2).

Descriptors: *Evapotranspiration, Evaporation, *Energy budget, Boundary layers, Latent heat, Idaho, Transpiration, *Sagebrush.
Identifiers: *Evaporative flux rates.

Evapotranspiration was measured from low sagebrush covered range land at the Reynolds Creek Experimental Watershed, Reynolds, Idaho. The objectives of the study were twofold: To measure the magnitude of and variation in evaporative flux rates for low sagebrush range; and To identify those parameters of the microclimate which were significant in causing daily and hourly variation in flux rates. Evapotranspiration (E.T.) from the low sagebrush range (38% crown cover), using the Bowen-ratio technique, indicates typical E.T. rates of 0.025 - 0.40 mm/hr. Losses during daylight hours ranged from 1.27 - 3.0 mm and represented 33 - 46% of the net radiation. Advection of sensible heat was negligible. Soil moisture during the May - June period ranged from 17 - 40% by volume. The instrumentation developed for Bowen - ratio energy balance measurements is also described.
W71-02830

SORGHUM FOLIAR RESPONSES TO CHANGES IN SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
W. L. Ehrler, and C. H. M. van Bavel.
Agronomy Journal, Vol 59, p 243-246, 1967. 5 fig, 11 ref.

Descriptors: *Sorghum, *Crop response, *Foliar, *Soil moisture, *Moisture content, Moisture stress, Soil-water-plant relationships, Temperature, Evapotranspiration, Transpiration, Arizona, Arid lands, Leaves, Moisture availability, Stomata, Plant physiology, Lysimeters, Resistance, Diurnal, Diffusion, Irrigation effects.
Identifiers: *Transpiration resistance, *Beta-ray gauge technique, Leaf temperature, Leaf thickness.

Plant response to field differences in water availability was measured in grain sorghum in central Arizona during July 1965. Measurements were made during two 24-hour periods of meteorological factors, transpiration resistance, leaf temperature and thickness evaporation in dry soil and, after irrigation, in wet soil. Limited soil water availability counteracted normal, light-induced stomatol opening. This caused increased daytime values of leaf diffusion resistance, decreased evapotranspiration, and caused leaf temperatures that exceeded air temperature. Leaf thickness (measured by a beta-ray gauge) decreased negligibly from the dawn reference value, even when the soil water content approached the 15-bar percentage. The absence of significant leaf response is a failure of the beta-ray gauge technique to measure water content of sorghum leaves. Figures show leaf diffusion resistance (by lysimeters), measured evaporation from dry and wet soil compared to potential evaporation, relative leaf temperature before and after irrigation and leaf thickness during the experiments. (Popkin-Arizona)
W71-02865

THE INFLUENCE OF XYLEM ARRANGEMENT AND TRANSPIRATION ON THE DISTRIBUTION OF SOLUTES IN COTTON,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
R. R. Hoverson, and Joseph Hacskaylo.
Texas A and M University, Texas Agricultural Experiment Station, MP-889, August 1968. 11 p. 8 fig, 3 tab, 2 ref.

Descriptors: *Transpiration, *Transpiration control, *Cotton, *Xylem, *Insecticides, Solutes, Plant physiology, Soil-water-plant relationships, Plant tissues, Leaves, Movement, Spatial distribution.
Identifiers: *Azodrin, Petiole infusion, Acropetal movement, Anastomosis, Lateral wall performations.

Irrigated cotton is an important crop in semiarid and arid lands. Covered cotton leaf experiments indicate that transpiration effect on Azodrin distribution following stem application and petiole infusion is direct. Accumulated insecticide in any plant part is proportional to transpired water from that part. The cotton xylem system dictates the destination of solutes because of its spatial arrangement. When the xylem system has access to the treatment solute, all plant parts may accumulate solute, depending on transpiration amount. When only specific xylem parts are insecticide treated, solute distribution is limited to subsequent acropetal ramifications and interconnections of those

ecific xylem elements. This distribution is by way f anastomosis and lateral wall perforations. The ecific conduits of insecticide movement are sub-ct to controlling transpiration forces, as the solute oves acropetally. Figures show Azodrin accumu-tion, leaf properties, and plant sections. Tables ow Azodrin distribution in cotton plants. (Pop-n-Arizona)
71-02968

HE ROLE AND MEASUREMENT OF DEW,
entralanstalt fuer Meteorologie und Geodynamik, ienna (Austria).
. Muller.
groclimatological Methods; Proceedings of the eading Symposium, Natural Resources Research, ol 7, p 303-307, UNESCO, 1968. 5 tab, 5 ref.

escriptors: *Evaporation, *Energy budget, *Arid nds, *Dew, *Estimating equations, Ther-odynamic behavior, Instrumentation, Measure-ent, Environmental effects, Climatology, Rime, icroenvironment, Data collections, Mode of ac-on, Microclimatology, Energy transfer, Evalua-on, Condensation, Air-earth interfaces, Heat alance, Temperature, Vapor pressure, Water alance, Precipitation (Atmospheric).
entifiers: *Agroclimatology, *Exchange coeffi-ent, Formulae.

arid and semiarid regions the role of dew as a rm of the energy balance is particularly impor-nt. Dew formation is a term connected with nega-ve heat balance of the surface, which allows the onstruction of a highly general formula. A large umber of instruments are available for dew and oisture measurements and methods and instru-ents are listed. For this reason it is difficult to hoose a standard instrument. Starting with the nergy balance equation, a universal exchange efficient is defined and a formula for the calcula-on of dew amount is derived. When calculated nd measured valves were compared for a site in ustria, satisfactory agreement was obtained. Sud-en local winds often caused dew evaporation. nly in one extremely dry month did the monthly otal of dew reach the magnitude of the rainfall--hich reflects the fact that dew is unimportant to he moisture balance except in very dry regions. Its nportant role lies in its persistence and resulting vaporation suppression. Further investigations are eeded on the importance of dew in connection ith evaporative processes. (Casey-Arizona)
71-02974

OTENTIAL EVAPOTRANSPIRATION IN A WARM ARID CLIMATE,
Meteorological Dept., Cairo (Egypt).
M. H. Omar.
groclimatological Methods; Proceedings of the eading Symposium, Natural Resources Research, ol 7, p 347-353, UNESCO, 1968. 5 tab, 10 ref.

escriptors: *Arid climates, *Advection, *On-site ata collections, *Estimating equations, Evapotranspiration, Climatology, Environmental ffects, Measurement, Instrumentation, Energy udget, Temperature, Solar radiation, Vapor pres-ure, Wind velocity, Rainfall, Summer, Winter, lonthly, Irrigated land.
dentifiers: *Potential evapotranspiration, *United rab Republic, *Agroclimatology, *Psychrome-ers, *Evapotranspirometers, Formulae.

Measurement of potential evaporation in warm rid areas is complicated by advection effects and sually requires a large (1-2 acres) irrigated field. Measurements were made in a small grass field in Cairo (1960-1965) with modified Mather vapotranspirometers and psychrometers (energy alance method) during both summer and winter. imilar measurements were made in a large grass ield (Gezira) which had similar climatological onditions. The data from the 2 measuring echniques were compared as well as the data from he 2 fields. Energy budget measurements were onsistently less than evapotranspirometer measurements and were explained by the effects of downward moisture advection. Using data from both types of measurement, Gezira/Giza evapotranspiration ratios were determined, showing how monthly evapotranspiration valves in a small field, measured by evapotranspirometers could be corrected for advection effects allowing estimation of average values for large fields. The corrected valves were then compared with calculations according to the Penman, Papadakis, Thornthwaite and Hamon methods. The Papadakis and Penman formulas were very accurate while the others underestimated by about 35 percent. It is felt that the simplicity of the Papadakis formula recommends its use in arid areas if its accuracy is established. (Casey-Arizona)
W71-02975

EVAPOTRANSPIRATION OF A NATURE CITRUS ORCHARD,
Florida Univ., Gainsville. Dept. of Fruit Crops.
J. F. Gerber.
Available from NTIS as PB-190 123, $3.00 in paper copy, $0.95 in microfiche. Final Report, January 1970. 22 p, 4 tab, 4 fig, 4 ref. Weather Bureau Grant WBG-84.
Identifiers: *Trees, *Evapotranspiration, Mathematical analysis, Energy, Water supplies, Temperature, Humidity, Radiation effects, Moisture, Rainfall, Soils, Wind, Irrigation systems, Recording systems, Micrometeorology, Data processing systems, Sampling, Fruits, Moisture balance, *Citrus trees.

The changes in soil moisture as measured with the neutron probe were used to calculate the hydrologic value of evapotranspiration. Since the mean change in soil moisture is dependent upon the volume of moisture exhaustion by the roots of the tree it was assumed that on the basis of the previous study that some adjustment should be made to compensate for a lack of uniformity in moisture usage. Consequently, each tree was assigned an area of 625 square feet since they were spaced 25 by 25. An adjustment for the volume around the trunk, the drip and that which remained in the middle was made. On this basis soil moisture changes were computed by the assignment of individually weighted constants to compensate for the percentage of each unit area that was involved in the area near the trunk beneath the canopy and in the middle. In this manner adjusted moisture use was obtained for a hypothetical column of soil with a unit cross section extending to a depth of 5 ft. Changes in the water content of this hypothetical column were used in the estimation of the hydrologic balance.
W71-03087

MEASURING FOREST EVAPOTRANSPIRATION - THEORY AND PROBLEMS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
C. Anthony Federer.
Forest Service Research Paper NE-165, 1970. 25 p, 1 fig, 1 tab, 68 ref, append.

Descriptors: *Evapotranspiration, *Forests, *Reviews, Advection, Consumptive use, Energy budget, Evaporation, Meteorology, Transpiration, Analytical techniques.
Identifiers: *Forest evapotranspiration.

Methods of estimating forest evapotranspiration are reviewed. Only the soil-water budget and the micrometeorological methods offer any degree of success. These procedures are described pointing out the limitations of the soil-water sampling method, but noting that the micrometeorological approach provides several related methods that offer the best opportunities for accurately measuring evapotranspiration. Mass transfer, eddy correlation, difference, Bowen ratio, and combinations are discussed. Less expensive and more reliable instruments must be developed before they can be used routinely for hydrologic research. (Knapp-USGS)
W71-03122

SOIL WATER EVAPORATION: FIRST STAGE DRYING AS INFLUENCED BY SURFACE RESIDUE AND EVAPORATION POTENTIAL,
Agricultural Research Service, Mandan, N. Dak. Soil Water Conservation Research Div.
J. J. Bond, and W. O. Willis.
Soil Science Society of America Proceedings, Vol 34, No 6, p 924-928, November-December 1970. 5 p, 7 fig, 1 tab, 13 ref.

Descriptors: *Evaporation, *Soil water, Hydraulic models, Model studies, Lysimeters, Mulching, Evaporation control, Water conservation, Air-earth interfaces.
Identifiers: *Soil water evaporation.

Evaporation rate was measured in wetted columns of fine sandy loam treated with straw as surface residue, at six different evaporation potentials. First stage (constant rate) evaporation rate decreased with either increasing residue depths or decreasing evaporation potentials. Total water loss during first stage drying decreased as the rate of first stage evaporation increased. Conversely, water loss for the first 24 days following first stage drying increased as first stage evaporation rate increased. (Knapp-USGS)
W71-03141

2E. Streamflow and Runoff

USE OF RUNOFF FORECASTING IN RESERVOIR OPERATIONS,
Salt River Project, Phoenix, Ariz.
For primary bibliographic entry see Field 04A.
W71-02758

A METHOD FOR RUNOFF-MAPPING FROM PRECIPITATION AND AIR TEMPERATURE DATA,
For primary bibliographic entry see Field 02A.
W71-02767

SURFACE WATERS AS ELEMENTS OF THE WORLD WATER BALANCE,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 02A.
W71-02768

CYCLIC VARIATIONS OF RIVER DISCHARGE IN THE NORTHERN HEMISPHERE,
State Hydrological Inst., Leningrad (USSR).
P. S. Kuzin.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 160-164, July 1970. 5 p.

Descriptors: *Streamflow, *Synoptic analysis, *Mass curves, Statistical methods, Statistics, Correlation analysis, Rainfall-runoff relationships, Frequency analysis, Mapping, Surveys.
Identifiers: River discharge variation.

Territorial regularities of distribution of cyclic variations, synphases and asynphases of streamflow rivers of the Northern Hemisphere were studied by normalized difference mass curves and correlation methods. The USSR and the territories of other countries of the Northern Hemisphere were classified according to the type of synphases of annual streamflow variations. Asynphases of streamflow and the possibility of compensation of low river discharge in some regions by high river discharge in other regions during the same years are possible. Modulus coefficients of both low and high streamflow phases decrease from north to south. For low flow the frequency increases from north to south, whereas for high flow, frequency decreases from north to south. The Zonal changes (from north to south) of modulus coefficients and of frequency of low and high streamflow phases are gradual. Intrazonal changes (from west to east) are uneven. Cyclic streamflow fluctuations of big rivers situated in the same geographical zone coincide with the fluctuations of streamflow of the adjacent middle-size rivers. (Knapp-USGS)

W71-02778

FORECASTING OF DRY WEATHER STREAM FLOW,
Baghdad Univ., (Iraq). Coll. of Engineering.
Adnan M. Alsaffar.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 122-129, July 1970. 8 p, 4 fig, 11 ref.

Descriptors: *Streamflow forecasting, *Hydrograph analysis, *Low flow, *Surface-groundwater relationships, Water storage, Bank storage, Discharge (Water), Recession curves.
Identifiers: Iraq.

Dry weather stream flow may be forecast by study of depletion of bank storage and basin storage discharges. The analysis is based on the method of hydrograph separation. Equations are derived for the forecasting of these discharges using the runoff hydrograph and the rainfall over the basin. Examination of the derived equations on a stream in Iraq showed the adequacy of this method. (Knapp-USGS)
W71-02780

WATER BALANCE OF SWAMPS AND ITS COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
L. G. Bavina.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 461-466, July 1970. 6 p, 1 tab, 8 ref.

Descriptors: *Water balance, *Swamps, Mathematical studies, Equations, Hydrologic cycle, Hydrologic budget, Meteorology, Climatology, Precipitation (Atmospheric), Runoff, Vegetation, Soil moisture, Evapotranspiration, Solar radiation, Evaporation, Topography, International Hydrological Decade, Foreign projects.
Identifiers: *USSR.

A method for computation of runoff from swamps developed on the basis of physical study of water motion in swamps and method for computation of evaporation from swamps depending on the rate of energy advection are presented in a study of water balance of swamps. Computation showed that the difference between long-term average annual values of water balance components of swamps in the zone of excessive moistening and water balance components of the whole river basins is not great. The difference lies within the limits of computation accuracy, which is about 10-12% of the computed values. (Woodard-USGS)
W71-02785

STUDY OF WATER BALANCE ELEMENTS OF FOREST AND FIELD WATERSHEDS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02786

THE REGULARITIES OF LONG-TERM FLUCTUATIONS OF STREAMFLOW AS A COMPONENT OF THE WATER BALANCE,
For primary bibliographic entry see Field 02A.
W71-02796

SURFACE WATER EVALUATION WITH LIMITED DATA IN THE ARID REGION OF WEST PAKISTAN,
Pakistan Planning Commission, Rawalpindi. Water and Power Div.
Sarfraz Khan Malik.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 471-487, January 1970. 17 p, 4 fig, 6 ref.

Descriptors: *Water resources, *Surface waters, *Evaluation, *Arid lands, Precipitation (Atmospheric), Runoff, Streams, Stream gages, Sediment load, Equations.
Identifiers: *West Pakistan, *Scarce data.

The total annual flow of the coastal and desert streams in the 134,700 square miles of the arid region of West Pakistan averages between 4 and 5 million acre feet. For evaluation of surface water resources in this arid region, a number of rain gages, and some automatic rain recorders have been set up to measure precipitation and rainfall intensities. Stream gaging stations have also been set up covering the important streams of the area for observing and maintaining river stage and discharge records. Some USGS type Class A Evaporation Pans have also been erected to measure lake evaporation in some areas. Principles and procedures of the evaluation are discussed in the analysis of precipitation data and stream gagings, stage-discharge relations of the streams, the formulation of rainfall-runoff relations, and estimation of the sediment loads of the streams which give an indication of the soil loss taking place from the water-borne river catchments. Topography in the region varies from denuded rocky mountains to some ranges covered with juniper forests. Elevations range from the Arabian Sea coast to about 8000 ft. Shifting controls make stream gaging complex. Large soil losses occur in some basins, ranging from 10,000 to 17,000 tons per sq mi in the Lehri, Chhattar, and others. (Woodard-USGS)
W71-02800

MAXIMUM ONE DAY FALLS OF PRECIPITATION IN TEHRAN,
United Nations Development Program, Tehran (Iran).
For primary bibliographic entry see Field 02B.
W71-02801

WATER INFLOW COMPUTATION OF THE PLANNED ANKARA CERKESHOYUK RESERVOIR,
Topraksu Central Research Inst., Ankara (Turkey).
For primary bibliographic entry see Field 04A.
W71-02804

A NOTE CONCERNING THE IMPROVEMENT OF THE MEAN ANNUAL RUNOFF MAP OF TURKEY,
For primary bibliographic entry see Field 07C.
W71-02805

FREQUENCY ANALYSIS OF RIVER STAGE DATA IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Aolad Hosain.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 383-394, January 1970. 12 p, 4 fig, 4 tab, 6 ref.

Descriptors: *Water resources, *Streamflow, *Frequency analysis, *Hydrologic data, *Foreign projects, River basins, Hydrographs, Discharge measurements, Gaging stations, Peak discharge, Low flow, Surface waters.
Identifiers: *East Pakistan, *River-stage data, Probability curve, Scarce data.

As a basic step in preparing the master plan for water resources development of East Pakistan, probability treatment was given to river stage data from 74 gaging stations on 39 rivers. The length of record of these stations varied from 4 to 54 years, the majority of which had about 15 years of record. Even after extending some of the short records by correlating with long record stations on the same river, it was often necessary to predict an event having a return period of 100 years on stations for which slightly less than 15 years of observed data are available. Because the flood stages of the major rivers of East Pakistan do not vary a great deal, stations with relatively short periods of records can safely be used to determine the stages of floods of rather long return intervals. Tabulations show that by any one frequency analysis technique the difference in 100-year flood stage with 58 years of data and 15 years of data is less than one foot. Actual difference is only 0.12 foot as shown by the mathematically fitted curve. It can also be seen in the tabulation that the simpler frequency analysis techniques give very nearly the same results as the more complex ones. (Woodard-USGS)
W71-02807

ANNUAL WATER LOSSES IN THE CEYHAN BASIN, TURKEY,
For primary bibliographic entry see Field 02A.
W71-02813

REVISION OF THE GAGING STATIONS IN UPPER CEYHAN BASIN, TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
Mete Turksoy.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 257-259, January 1970. 3 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Streamflow, *Gaging stations, *Planning, *Runoff, *Foreign projects, Flow characteristics, Flow rates, Peak discharge, Low flow, Surface waters.
Identifiers: *Turkey, *Site selection (Gaging stations).

There are 13 streamflow gaging stations in the Upper Ceyhan Basin, Turkey which are in operation at present. Correlations between mean maximum and minimum discharges are made to determine stations that can be discontinued and stations that can be operated only for maximum and minimum discharges. Meanwhile certain sites are located for new stations. Station and river names, data correlation coefficients, standard error percentages, and results of data correlations are presented in tables and maps. (Woodard-USGS)
W71-02814

ZONES AS TO ANNUAL STREAMFLOW VARIATION IN TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
Cihangir Kalkan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 247-255, January 1970. 9 p, 10 fig, 1 tab, 3 ref.

Descriptors: *Water resources, *Rivers, *Streams, *Foreign projects, Runoff, Streamflow, Gaging stations, Hydrographs, Average, Annual, Discharge (Water), Network design.
Identifiers: *Turkey, Regimen curves, Discharge zones.

Regimen curves of annual average stream discharges for 48 sites in Turkey for the period 1953-66 are presented. The 9 discharge zones into which Turkey is divided, and the station locations are shown on a map. The report is intended as an aid in appraising the general hydrological characteristics of the country and in planning alterations in the streamflow gaging network design. (Woodard-USGS)
W71-02815

THE ESTIMATION OF FACTORS CONTROLLING STREAMFLOW IN AREAS WITH LIMITED DATA,
Institute of Hydrology, Wallingford (England).
J. S. G. McCulloch.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With

Scarce Data, March 4-8, 1969, Tehran, Iran, p 171-180, January 1970. 10 p, 2 tab, 14 ref.

Descriptors: *Water resources, *Streamflow, *Control, *Streamflow forecasting, Hydrologic data, Equations, Precipitation (Atmospheric), Evaporation, Transpiration, Air temperature, Humidity, Foreign projects, River basins, Soil moisture.
Identifiers: *Scarce data, Catchment area research, Control factors.

The streamflow at a given point in a given drainage area depends primarily on the total precipitation falling within the area and on the soil moisture status of the catchment. Where data are scarce, soil moisture must be derived indirectly either by use of an estimate of antecedent precipitation or by estimation of evaporation to enable computation of a water balance. This report relates some of the methods and factors involved with these computations. In areas of scarce data, topography and vegetation are used to estimate precipitation. In Western Iran, for example, it was established that there exists a fairly uniform precipitation/altitude gradient of 300 mm/1,000 m and that when rainfall values are corrected to a standard altitude of 1,000 m the worst of the scatter is removed from the data and an isohyetal map can be drawn. Average precipitation for a given catchment is then derived by interpolation or by planimetering using this constant altitude isohyetal map and adjustment to the mean of the watershed. (Woodard-USGS)
W71-02818

DROUGHT FREQUENCY ANALYSIS BY MEANS OF SYNTHETIC FLOW SEQUENCES,
State Hydraulic Works, Ankara (Turkey). Hydrology Section.
Samin Oztek.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 155-166, January 1970. 12 p, 6 fig, 2 tab, 6 ref.

Descriptors: *Water resources, *Droughts, *River basins, *Synthetic hydrology, *Streamflow, Foreign projects, Model studies, Equations, Streamflow forecasting, Hydrologic data, Discharge measurements, Mass curves.
Identifiers: *Euphrates Basin, *Keban (Turkey), *Scarce data, Synthetic-flow sequences, Drought frequency.

Hydrologic drought is defined as the deficit of water below a given reference value. In the stochastic model of Euphrates Basin hydrology at Keban, Turkey, it was assumed that the population of monthly flows was statistically normal. The data generation method was used on the normally distributed variables and 6,000 monthly flows generated. For selected reference values magnitude and duration of deficits have been computed. Then, joint distribution of magnitude and duration of deficits was determined. Reservoir capacity necessary to meet particular draft rates during critical droughts having various recurrence intervals is determined. The mass curve analysis based on the 500 yr synthetic records made it possible to determine the capacity necessary to meet a particular draft rate for various droughts having recurrence intervals ranging from 2 yr to 500 yr. (Woodard-USGS)
W71-02821

THE DROUGHTS OF ANTIGUA,
Halcrow (William) and Partners, London (England).
N. J. Cochrane.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 117-128, January 1970. 12 p, 3 fig, 3 tab, 5 ref.

Descriptors: *Droughts, *Water resources, *Rainfall, Tropical regions, Islands, Equations, Rainfall disposition, Storms.
Identifiers: *Antigua Island (Caribbean).

Antigua, a tropical island in the Caribbean, has a tropical oceanic climate and an average annual rainfall of about 45 inches. There are considerable variations in the annual amounts of rainfall, and recurrent and persistent droughts are a serious problem for the inhabitants. The sugar industry has collapsed under the joint burdens of low prices and drought but its place has been taken, on a grand scale, by tourism. Unfortunately, although the tourist desires clear skies and an absence of rain, he also requires fresh water in abundance so the island's difficulty has not been resolved but is merely oriented differently. Average annual rainfall, rainstorm indices, standard deviation, and frequency diagrams are correlated in evaluating the water resources of the Island. (Woodard-USGS)
W71-02822

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 03B.
W71-02827

SIGNIFICANCE OF CAMILLE (1969),
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02B.
W71-02908

PREPARATION OF LONG TERM FLOW SEQUENCE FROM SHORT TERM RECORD BY STATISTICAL MEANS,
Ministry of Water and Power, Tehran (Iran).
Davoud Hariri.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 139-154, January 1970. 16 p, 2 fig, 2 tab.

Descriptors: *Water resources, *Droughts, *Hydrologic data, *Streamflow, Synthetic hydrology, Methodology, Streamflow forecasting, Statistics, Computers, Foreign projects, Watershed management, River basins.
Identifiers: *Marun River (Iran), *Karun River (Iran), *Scarce data, Drought frequency, Synthetic-flow sequence method, Flow duration probability.

This paper describes two methods for carrying out drought frequency analysis for the Marun River basin in Khuzistan, Iran. In the first method a synthetic sequence of hypothetical flows was generated using an electronic computer; flow sequence is derived from the 13 years of historic record. In the second method a long record was drawn up by standard correlation procedures with the nearby Karun River. A very restricted range of flow variation is indicated in the first method compared with the second. The existing record, however, indicates that results of the second method are to be preferred and that the variability characteristics of the river basin are better preserved in the extended record obtained by correlation than in the flow sequence generated synthetically. The use of elaborate techniques requiring sophisticated equipment and computer programs is not necessarily to be preferred to standard methods as shown by a comparison of results of this study. Careful examination of the available data can indicate where the computer and synthetic methods require checking against standard methods. (Lang-USGS)
W71-02920

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 9. COLORADO RIVER BASIN - VOLUME 2.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-02924

EVALUATION OF THE STREAMFLOW-DATA PROGRAM IN OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 07A.
W71-02925

A PROPOSED STREAMFLOW DATA PROGRAM FOR WISCONSIN,
Geological Survey, Madison, Wis.
For primary bibliographic entry see Field 07A.
W71-02926

MISCELLANEOUS STREAMFLOW MEASUREMENTS IN IDAHO, 1894-1967,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 07C.
W71-02927

DETERMINATION OF PROBABILITY DISTRIBUTION OF MAXIMUM DISCHARGES ON THE BASINS OF ALL OBSERVED FLOODS,
Technical Univ. of Warsaw (Poland).
W. Strupczewski.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 41-51, 1969. 11 p, 3 fig, 8 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Rainfall, Snowmelt, Rainfall-runoff relationships, Correlation analysis, Peak discharge, Storm runoff.
Identifiers: Poland.

Floods from rainwater and meltwater may appear in Poland several times within one year, while in other years no distinct floods occur. By adopting the hypothesis of mutual independence of these events, it becomes possible in computation of the annual probability of maximum seasonal discharges to take into account all suitably defined floods. The type of probability distribution used for all floods is completely defined by the hypothetical type of the probability distribution of annual maximum discharges and a given transformation equation. The probability distribution of the maximum annual discharges is obtained from the seasonal discharges by determining the alternate probability of the independent events. The hypothesis of the mutual independence of the maximum discharges from rainfall and from meltwater was verified in numerous gage records from Polish rivers. The basic factor conditioning the applicability of the method of 'all floods' is the evaluation of the accuracy of estimation of probable maximum discharges obtained in this way, in comparison with the values obtained by the traditional method. This problem was solved with the aid of the assumption that both the sets of annual maximum discharges and those of the flood waves are subject to the Fisher-Tippett (type I) distribution. (Knapp-USGS)
W71-02929

IMPROVED PRECISION OF FUTURE HIGH FLOODS,
Central Water and Power Research Station, Poona (India).
G. M. Panchang.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 51-59, 1969. 9 p, 2 tab, 6 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Reviews, *Probability, Analytical techniques, Peak discharge, Streamflow forecasting.
Identifiers: Flood forecasting techniques.

Methods of predicting maximum streamflows for the design of waterway structures are critically reviewed. Gumbel (1941) postulated initially the use of the Extreme Value Distribution law for evaluating the design floods for the construction of structures across waterways. But the method of moments proposed for estimating its two parameters from the available short term data of annual peak flow were not thought sufficiently precise.

Kimball (1946) discussed the application of the method of Maximum Likelihood for the purpose, but concluded (1956) that one of the resulting normal equations was as intractable of solution. Panchang and Aggarwal (1962) proceeded further and reduced all the routine computational steps to a schematized format for evaluating the parameters successfully and thereby for producing the requisite longterm peak estimates more precisely. The reasons leading to better consistency of such estimates are discussed. (Knapp-USGS)
W71-02930

PRINCIPLES FOR ELABORATION OF MATHEMATICAL RUNOFF MODELS,
Moscow State Univ., Moscow (USSR).
G. P. Kalinin, L. S. Kuchment, and V. I. Koren.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 60-65, 1969. 6 p, 10 ref.

Descriptors: *Runoff forecasting, *Streamflow forecasting, *Mathematical models, Mathematical studies, Reviews, Rainfall-runoff relationships, Water balance, Hydrologic budget.
Identifiers: USSR, Runoff models.

Two approaches to developing mathematical models of runoff formation are discussed: (1) A basin is considered to be a system whose parameters are unknown and can be determined by means of input and output characteristics; (2) It is assumed that the physical parameters determining runoff formation can be measured directly. On the basis of this assumption a system of differential equations which includes these parameters as partial derivatives is composed. The second method of approach makes it possible to describe the physical processes occurring in the basin in more detail, however its application is rather limited because of great space variation of the physical parameters. Methods of solving inverse problems developed in recent years make it possible to use this method of approach more widely and to bring together both tendencies in developing mathematical models. (Knapp-USGS)
W71-02931

A NUMERICAL MODEL OF THE RUNOFF PROCESS OF MOUNTAIN RIVERS,
U. M. Denisov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 65-71, 1969. 7 p, 3 fig.

Descriptors: *Flood forecasting, *Mathematical models, Runoff forecasting, Streamflow forecasting, Systems analysis, Hydrograph analysis, Mathematical studies, Correlation analysis, Discharge (Water), Numerical analysis.
Identifiers: Runoff models.

A mountain river basin is considered as a dynamic system transforming the function of water income to the surface of the basin into a runoff function at the outlet. The design model of snowmelt and rain water income onto the surface of a basin needs data on daily mean air temperature, daily mean humidity and daily amount of precipitation at several (2-5) meteorological stations placed in the basin or near it. Evaporation is assumed to be proportional to saturation deficit and total volume of liquid water content in the basin. The transforming operator of the dynamic system is found on the hypothesis that there is a monotonic rise of correlation curve between discharge at the outlet section and volume of liquid water content in the basin. The method of moments gives a possibility of obtaining a system of equations defining optimum values of transforming operator parameters. The relative error of the discharge hydrograph thus calculated is determined and the parameters' stability is evaluated. (Knapp-USGS)
W71-02932

AN ESTIMATE OF DISCHARGE PROBABILITIES,
Research Inst. for Water Resources Development, Budapest (Hungary).
J. Csoma.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 72-83, 1969. 12 p, 4 fig, 3 tab, 11 ref.

Descriptors: *Streamflow forecasting, *Discharge (Water), *Mathematical models, *Probability, *Statistical models, Mathematical studies, Statistics, Rainfall-runoff relationships.
Identifiers: Runoff models.

Statistical methods for determining the distribution of the numerical random variables characterizing flood discharges are reviewed. The analysis of the most wide-spread methods showed that the calculated distribution functions in many instances do not satisfy the physical conditions of the phenomenon or meet the requirements of exact mathematical statistics. Generally it can be stated that every monotonic increasing and continuous function can be applied as a distribution function for determining discharges of different probability, wherein at the zero value of the independent variable the dependent variable equals zero, and at the infinite value of the independent variable the dependent variable assumes the value of unity. This definition, however, is not yet in harmony with the physical character of the phenomenon. Among the annual maximum discharges of every permanent watercourse there must be one, below which discharges of smaller value present themselves all with zero probability. The system of equations describing the distribution function is therefore modified so that there is a discharge below which discharges of smaller value have zero probability. (Knapp-USGS)
W71-02933

THE ESTIMATION OF EXTREME PRECIPITATION AS THE BASIS FOR DESIGN FLOODS - RESUME OF PRACTICE IN THE UNITED STATES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
Vance A. Myers.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 84-104, 1969. 21 p, 6 fig, 54 ref.

Descriptors: *Design flood, *Design storm, *Flood forecasting, *Spillways, Probable maximum precipitation, Reviews, Maximum probable flood, Bibliographies, Routing, Hydrology, Water management (Applied), Flood protection, Flood control, Reservoir design, Reservoir operation.
Identifiers: Flood control project design, Spillway design.

The spillways of most large dams built in the United States in the last 25 years are designed to carry the flood resulting from probable maximum precipitation. The historical reasons for this particular approach to design in the United States are reviewed, the procedures that have evolved for estimating probable maximum precipitation are summarized, and design trends are discussed. (Knapp-USGS)
W71-02934

DESIGN RAINFALL CHARACTERISTICS OF THE USSR TERRITORY,
State Hydrological Inst., Leningrad (USSR).
E. A. Smirnova.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 105-114, 1969. 10 p, 2 fig, 3 tab, 3 ref.

Descriptors: *Design storm, *Hydrograph analysis, *Rainfall-runoff relationships, Rainfall intensity, Rainfall disposition, Statistical methods, Hyetographs, Duration curves.
Identifiers: USSR.

A method of processing hyetographs to obtain design rainfall characteristics used in maximum storm runoff computation is summarized. The technique provides, for a homogeneous climatic region: (1) The plotting of a curve of maximum depth increase with time interval increase and (2) The plotting of a curve of mean rainfall intensity decrease with time interval increase for certain exceedence or frequency probabilities. Depth of rainfall intensity for a required time interval can be determined for any point with known daily rainfall. Ordinates of reduction curves are only slightly dependent on frequency and change slowly. Curves of rainfall reduction have been plotted for different physiographical regions of the USSR and characteristics of the main types of reduction curves and their territorial distribution are given. (Knapp-USGS)
W71-02935

OBJECTIVE STATISTICAL METHODS OF COMPUTATION AND GENERALIZATION OF THE PARAMETERS OF MAXIMUM RAINFALL RUNOFF,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02936

APPLICATION OF THE METHOD OF MAXIMUM RUNOFF COMPUTATION USING THE PRECIPITATION REDUCTION CURVES IN THE MARITSA RIVER BASIN,
Bulgarian Academy of Sciences, Sofia. Inst. of Hydrology and Meteorology.
S. G. Georgiev.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 128-135, 1969. 8 p, 3 fig, 1 tab.

Descriptors: *Flood forecasting, *Floods, *Statistical methods, *Estimating, *High water mark, *Surveys, Frequency analysis, Probability, Rainfall-runoff relationships, Water balance.
Identifiers: Bulgaria.

A method is described for computing rainfall-runoff relationships for river basins by plotting frequency curves based on maximum precipitation data used with stage data obtained from a flood-height survey by questionnaire. The method was developed to compute maximum runoff in the Maritsa Basin, Bulgaria, a basin without adequate gaging stations for standard flood-runoff computations. (Knapp-USGS)
W71-02937

ON THE EXPEDIENCY OF USING COMBINED SERIES OF HYDROLOGICAL CHARACTERISTICS FOR FLOOD COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
A. I. Chebotarev, and B. I. Serpik.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 135-144, 1969. 10 p, 4 fig.

Descriptors: *Flood forecasting, *Statistical methods, Probability, Frequency analysis, Estimating, Rainfall-runoff relationships, Regression analysis.
Identifiers: *USSR.

Parameters of runoff frequency curves derived from small samples with great variability result in considerable errors of runoff computation. The adjustment of frequency curve parameters to long-term observation periods and the analysis of information concerning streamflow and hydrometeorological characteristics in homogeneous physiographic regions are usually performed with the aim of decreasing this error. To overcome the difficulties encountered in calculations, hydrological series are combined in a population within homogeneous regions. This population is considered as a stable general one, which can be used for distribution characteristics at any point

(discharge site) in a given region. The condition when ordinates of individual frequency curves are within conventionally selected limits is sometimes taken for the series homogeneity criterion; these limits are assumed to be the difference between the ordinates of 3% and 97% frequency from the general population. The combined series criterion does not provide a homogeneous population. Moreover the existing correlation relationship between runoff of adjacent streams causes a greater instability in time of the generalized curve depending on the rate of streamflow of the period for which the series is produced. The conditions result in a considerable decrease in the calculation accuracy on available long-term series and in complete indeterminacy of calculation for discharge sites with short-term periods of observation. (Knapp-USGS)
W71-02938

ESTIMATING THE ACCURACY OF STATISTICAL FLOOD VALUES BY MEANS OF LONG-TERM DISCHARGE RECORDS AND HISTORICAL DATA,
E. Glos, and R. Krause.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 144-151, 1969. 8 p, 3 fig, 2 tab, 9 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Estimating, Sampling, Surveys, Frequency analysis, Gaging stations, Data collections.
Identifiers: Flood data analysis.

Short-term records are frequently used for estimating peak flows at different recurrence intervals. To determine the accuracy of these estimates empirical frequency curves are established from long-term records and additional historical information. The long-term records are divided into parts of various length to estimate the relationship between accuracy and length of record. The results are valid for a limited range of coefficient of variation from 0.4 to 0.7. (Knapp-USGS)
W71-02939

ASSESSMENT OF A DESIGN DISCHARGE OF A RIVER,
J. W. Van der Made.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 152-164, 1969. 13 p, 8 fig, 2 tab, 1 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Frequency analysis, *Design flood, Design flow, Streamflow, Hydrographs, Maximum probable flood, Project planning.
Identifiers: Flood frequency.

The concept 'maximum discharge that will ever occur' is incorrect; there is no cause for a fixed discharge ceiling. However, it is possible to assess a design discharge based on the acceptable risk. It can be derived from the frequency curve of the peak discharges of flood waves. If the period of observation from which the frequency curve is derived is much shorter than the proposed lifetime of the project is is necessary to extrapolate the frequency curve. It is illogical to expect the discharges, caused by complicated hydrological and geographical conditions, to follow a simple mathematical scheme. A graphical presentation is preferable; a linear scale of discharges and a logarithmic scale of frequencies are suitable. A method for the extrapolation of the frequency curve is discussed. (Knapp-USGS)
W71-02940

ESTIMATION OF FLOOD FLOWS USING MATHEMATICAL STATISTICS,
Energoprojekt, Belgrade (Yugoslavia).
M. Melentijevich.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 164-174, 1969. 11 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Probability, Frequency analysis, Streamflow, Analytical techniques, Hydrograph analysis, Peak discharge.
Identifiers: Danube River, Drina River.

The estimation of frequency of floods is considered from the viewpoint of mathematical statistics. This requires, essentially, the estimation of the tail of a probability distribution curve from a sample of values which usually does not include values in this tail. The error in the estimation of floods corresponding to a given probability arises from the uncertainty as to the mathematical form of the distribution and the uncertainty arising from the statistical errors of estimation of the parameters of the distribution, which occur because of the finiteness of the length of record. These errors are illustrated on a numerical example by fitting a log-normal distribution to annual values of extreme flow of the Danube and Drina Rivers for different lengths of records. (Knapp-USGS)
W71-02941

SPATIAL AND TEMPORAL ANALYSIS OF MAXIMUM RUN-OFF,
Moscow State Univ., Moscow (USSR).
G. P. Kalinin, and N. V. Nikolskaya.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 174-183, 1969. 10 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Runoff forecasting, *Streamflow forecasting, *Statistical methods, Data collections, Hydrologic data, Regression analysis, Frequency analysis, Probability, Discharge (Water).
Identifiers: *USSR.

Runoff observation data of the Northern hemisphere are summarized. In a large territory for a given period of time regions can be distinguished where runoff rate is extremely low and where runoff rate is extremely high. In the Northern hemisphere some regions have predominantly synchronous runoff (positive correlation) and some regions have predominantly asynchronous runoff (negative correlation). For a large territory the influence of reciprocal correlation on the shape of runoff distribution curves is balanced reciprocally. Under these conditions the use of observations in time and space permits generalized frequency curves of runoff which take into account a theoretical probability scheme of runoff formation. The shape of the theoretical frequency curves of runoff depends essentially on the period of averaging; the longer the period the less is the asymmetry. Generalization of frequency curves of runoff substantiates the choice of design values of flood runoff. (Knapp-USGS)
W71-02942

ON A GENERAL THEORY OF DURATION CURVE AND ITS APPLICATION TO EVALUATE THE PLOTTING POSITION OF MAXIMUM PROBABLE PRECIPITATION OR DISCHARGE,
India Meteorological Dept., New Delhi.
S. Banerji, and D. K. Gupta.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 183-193, 1969. 11 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Streamflow forecasting, *Duration curves, *Probability, *Mathematical studies, Statistical methods, Hydrographs, Design flood, Design flow, Probable maximum precipitation.
Identifiers: *India.

A generalized theory of duration curve for known length of record and sample size is given. The plotting position of each of the sample values used in the construction of the curve can be readily calculated to a high degree of accuracy without using the method of successive approximations from a polynomial of degree equal to the size of the sample. The theory has a special utility in the evaluation of plotting positions of certain values not present in the sample, for use in design purposes. The technique has been applied for obtaining the maximum probable precipitation and the maximum probable flood of a desired return period with a specified probability of non-exceedence. (Knapp-USGS)
W71-02943

ON THE METHOD OF UNIT HYDROGRAPH AND MODELLING OF RAINFALL FLOODS BY ELECTRONIC ANALOGUE COMPUTERS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02944

COMPUTATION PRINCIPLES OF FLOOD HYDROGRAPHS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02945

DETERMINATION OF MAXIMUM FLOW FROM HIGHWATER MARKS. (FRENCH),
Grenoble Univ. (France).
M. Parde.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 230-238, 1969. 9 p.

Descriptors: *Floods, *High water mark, *Flood forecasting, *Historic flood, Peak discharge, Roughness (Hydraulic), Channel morphology, Stage-discharge relations, Probability.
Identifiers: Probable maximum flood.

Extreme historical floods can be of great service, when through their interpretation it can be presumed with reasonable certainty that discharges higher than the highest recent discharges took place in the past. This is also confirmed by indications derived from the computation of probabilities. The available highwater marks must not be displaced vertically since recent floods. There must be a reliable relation between the height of the bench-mark and that of a neighbouring gage with a known stage-discharge relationship. Stages may differ considerably at different banks and at places upstream and downstream from bridges. It is also necessary to know whether the cross-sections, the slope and the channel roughness of the river are natural or artificial. (Knapp-USGS)
W71-02946

INCREASING THE ACCURACY OF DETERMINATION OF MAXIMUM DISCHARGES AND THEIR EXCEEDENCE PROBABILITY,
E. V. Boldakov.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 238-245, 1969. 8 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Streamflow forecasting, *Reservoir design, *Discharge (Water), Water balance, Hydrologic budget, Rainfall-runoff relationships, Reservoir construction, Planning, Water management (Applied).
Identifiers: Reservoir planning.

Improved distribution curves may be used to determine maximum discharges on large and medium rivers. Methods are given to determine maximum discharges for small watersheds by means of solution of the water balance equation. This solution enables account to be taken of water storage in the upper pool of a reservoir. An annual decrease in reinforced concrete consumption of 25% is possible while satisfying storage requirements. (Knapp-USGS)

W71-02947

EXTRAPOLATION OF DISCHARGE RATING CURVES USING CHEZY'S FORMULA,
State Hydrological Inst., Leningrad (USSR).
R. A. Shestakova.
In: Floods and Their Computation, Vol 1, International Association of Scientific Hydrology Publication No 84 (Unesco-WMO), p 245-252, 1969. 8 p, 1 fig.

Descriptors: *Discharge (Water), *Stage-discharge relations, *Chezy equation, Discharge measurement, Floods, Flood plains, Water levels, Data collections, Streamflow forecasting, Hydrograph analysis, Hydraulics.
Identifiers: Rating curves.

Investigations were made on the development of hydraulic methods of discharge curve extrapolation for discharge sites with and without flood plains. These methods form the basis of design dependences in the extrapolation zone of the curves. The investigations are based on the study of the variation of hydraulic resistance, defined by the coefficient C of Chezy's formula and the water surface slope for different water levels in the channel, and make use of a great amount of data. (Knapp-USGS)
W71-02948

WATER IN MARYLAND: A REVIEW OF THE FREE STATE'S LIQUID ASSETS,
Geological Survey, Towson, Md.
Patrick N. Walker.
Maryland Geological Survey Educational Series No 2, 1970. 52 p, 28 fig, 1 map.

Descriptors: *Water resources, *Maryland, *Hydrologic budget, Water balance, Water utilization, Precipitation (Atmospheric), Evapotranspiration, Surface waters, Streamflow, Water yield, Discharge (Water), Groundwater, Tides, Estuaries, Water quality, Water resources development.

This report is intended to present to the citizens of Maryland an account of the State's water resources. Chapters are titled as though they dealt with parts of a financial budget because water resources must be managed just as finances must be managed. The climate of Maryland is temperate and subhumid. Average annual temperature ranges from about 48 degrees F in the mountains to about 58 degrees F in the southern Coastal Plain. In a typical year the State receives 20,000 billion gallons of water as precipitation of streamflow. In addition, an estimated 130,000 billion gallons of groundwater are contained in the rocks of the state. Maryland's average precipitation is about 42 inches per year. In general, precipitation is higher in the eastern and extreme western parts of the State than it is in the west-central part. Of 42 inches of precipitation each year, about two-thirds or 28 inches is lost to evapotranspiration. Each year about 14,000 billion gallons of water leave the State as streamflow. Some 11,000 billion gallons of this water originates outside of Maryland. Maryland is not in a flood-plagued region and floods are rarely a problem. Maryland's waters are generally of excellent quality. (Knapp-USGS)
W71-03117

A SYSTEMS STUDY OF STORM RUNOFF PROBLEMS IN A NEW TOWN,
Hittman Associates, Columbia, Md. Environmental Sciences and Engineering Dept.
For primary bibliographic entry see Field 06A.
W71-03125

WATER RESOURCES AND RELATED GEOLOGY OF DERA ISMAIL KHAN DISTRICT, WEST PAKISTAN, WITH REFERENCE TO THE AVAILABILITY OF GROUNDWATER FOR DEVELOPMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-03132

CREST-STAGE GAGING STATIONS IN OREGON - A COMPILATION OF PEAK DATA COLLECTED FROM OCTOBER 1952 TO SEPTEMBER 1970,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 07C.
W71-03133

2F. Groundwater

DISTINGUISHING WINTER FROM SUMMER RECHARGE TO GROUNDWATER IN SOUTHERN ARIZONA BY DEUTERIUM ANALYSIS,
Arizona Univ., Tucson; and Geological Survey, Denver, Colo.
E. S. Simpson, David B. Thorud, and Irving Friedman.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 100-101, July 1970. 2 p.

Descriptors: *Recharge, *Groundwater basins, *Arizona, *Deuterium, *Tracers, Aquifers, Stable isotopes, Rainfall, Snowmelt, Hydrologic cycle, Weather patterns, Groundwater movement, Sampling, Water wells, Radioactive dating.
Identifiers: Tucson Groundwater Basin.

The Tucson Groundwater Basin in southern Arizona covers an area in excess of 700 square miles, and has an alluvial aquifer more than 1,000 feet thick. The apparent age of groundwater as determined by C-14 analyses ranges from zero (near recharge areas) to about 6,000 years. Average annual precipitation is about 11 inches, slightly more than half of which occurs during the summer as convective storms and most of the remainder during the winter as frontal storms. Summer moisture mostly originates in the Gulf of Mexico and winter moisture mostly comes from the Pacific Ocean. All streams in the basin are intermittent. To estimate the relative importance of winter versus summer precipitation in recharging the Basin, the distribution of deuterium was studied in rainfall, snowmelt, stream flow and groundwater. Fifteen summer storms in 1968 show a weighted average deuterium value of -4.7% (relative to SMOW) and 14 winter storms in 1968-1969 show a weighted average value of -5.8%. Two groundwater samples from wells near a recharge area show -6.6 and -6.3% values. Two other wells in widely separated parts of the valley, tapping much older water, show values of -5.8% each. The deuterium values for most snowfall and snowmelt in the surrounding mountains range from about -6 to -11%. Winter runoff is the dominant factor in producing recharge. (Knapp-USGS)
W71-02769

WATER BALANCE PECULIARITIES OF KARST AREAS,
State Hydrological Inst., Leningrad (USSR).
O. L. Markova.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 524-530, July 1970. 7 p, 1 fig, 3 tab, 7 ref.

Descriptors: *Water balance, *Geomorphology, *Surface waters, *Groundwater, Karst, Regions, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Hydrologic data, Climatic data, Meteorological data, River basins, Precipitation (Atmospheric), Runoff, Evapotranspiration, Water storage, International Hydrological Decade, Foreign projects.
Identifiers: *USSR, *Karst areas.

Peculiarities of water balance of regions with covered karst and examples of quantitative estimate of karst effect on river runoff are described. Karst influence on river runoff and its losses depends on the type of karst, on the kind and thickness of covering rocks, on the systems of drainage of rocks on climate, and other physiographical factors. Peculiarities of water balance of karst basins are studied from the combined usage of the two methods: water balance method and method of hydrological comparison. The methods were used to estimate peculiarities of water balance of river basins of some karst regions of the USSR with covered carbonate and sulphatic-carbonate karst. Investigations were based on observational data from hydrometeorological stations and on surveys of some project and research institutes. The results of investigations showed that in slightly dislocated plain karstic regions the difference between the surface and underground water divides of drainage basins up to 1000-2000 sq km is not great. (Woodard-USGS)
W71-02799

INVESTIGATION OF GROUND-WATER RESOURCES IN THE DASHT-MOGHAN AREA, AZARBIJAN, IRAN,
Tehran Regional Water Authority (Iran).
F. Frouzan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 395-405, January 1970. 11 p, 6 fig, 3 tab.

Descriptors: *Water resources, *Groundwater, *Water wells, *Foreign projects, Geologic formations, Aquifers, Water quality, Chemical analysis, Soil moisture, Temperature, Surface waters.
Identifiers: *Iran, Scarce data, Surface-water samples, Suspended sediment, Soluble salts, Carbonate hardness.

This paper is a part of the geological study on the pliocene sediment in the Dasht Moghan area of Iran that was carried on by the author from 1965-1966. The purpose of the study is to outline the parts of the Dasht-Moghan area where limited scale withdrawals of fresh water are possible and to delineate the areas that are not favorable for the development of water and irrigation supplies from groundwater. Groundwater areas in the Dasht-Moghan region range from those where there is no fresh water to those where more than 40 meters of fresh water-bearing conglomerate lies between the surface and a depth of 100 meters. In general, two prolific water-bearing conglomerates occur in the Dasht-Moghan area. Many parts of the Dasht-Moghan area would yield fresh water in limited quantities comparable to those withdrawn in the northeast, the most heavily pumped area. In the southeast area, the fresh water is rare. (Woodard-USGS)
W71-02806

ESTIMATING THE VOLUME OF AN AQUIFER BY USING CHLORIDE TRACER,
State Hydraulic Works, Ankara (Turkey). Dept. of Research.
Fuat Senturk.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 323-340, January 1970. 18 p, 12 fig, 5 tab, 5 ref.

Descriptors: *Water resources, *Groundwater, *Volume, *Foreign projects, Chlorides, Aquifers, Rainfall, Runoff, Seepage, Feeding rates, Water analysis.
Identifiers: *Konya Plain (Turkey), *Chloride tracer.

Methods and results in determining the volume of an aquifer by means of the changes in chloride concentrations in water as applied in Konya Plain, Turkey are given. Only the largest and deepest water-bearing horizons in Konya Plain were studied. Groundwater hydrology in the area, as related to certain chemical constituents, were considered in formulating equations and hydrographs. The method developed gives quite reasonable results under the assumptions made and compares satisfactorily with other existing methods. Konya Plain is 200 km long. Of the 200 or more wells on the plain, 25 were used for observation in this study. The wells are in calcareous rocks, mostly

mestone and conglomerate, and depth to water is etween 120 and 200 m. Recharge is from the inter and spring rains on the limestone terrane of ie south slopes and causes a decrease in the hloride concentration of the aquifer during the iny season. Earlier studies indicate that seepage om rainfall amounts to about 25%. Groundwater eserves are estimated to be 30 to 40 x 10 (9th ower) cubic meters. (Woodard-USGS)
71-02810

ATER BALANCE OF NATURAL UN-ERGROUND STORAGE,
ater Research Association, Medmenham (En-and). Hydrology Div.
A. Cole.
: Proceedings of Central Treaty Organization eminar on Evaluation of Water Resources With arce Data, March 4-8, 1969, Tehran, Iran, p 299-22, January 1970. 24 p, 8 fig, 3 tab, 45 ref.

escriptors: *Groundwater, *Water balance, *Un-erground storage, *Natural resources, Reviews, ydrologic data, Aquifers, Analog models, Equa-ons, Discharge, Water wells, Drill holes, Water ta-e.
entifiers: Research, United Kingdom, Borehole gging.

ethods of data and information acquisition con-rning groundwater hydrology are reviewed in-uding reconnaissance by air and ground survey; xplorations by drilling, lithological examination nd test pumping; operation of hydrometric net-ork by water level and discharge observation and outine sampling for chemical analysis; and ex-oitation of available resources by planned pump-g, possibly with artificial diversion of surface aters to the underground. Analog techniques are escribed in formulating equations in model stu-es. Results are included in tables, graphs, and aps. (Woodard-USGS)
71-02811

UBSIDENCE AND GROUNDWATER OFF-AKE IN THE BATON ROUGE AREA,
ouisiana Water Resources Research Inst., Baton ouge.
illiam A. Wintz, Jr., Raphael G. Kazmann, and harles G. Smith, Jr.
vailable from NTIS as PB-196 311, $3.00 in aper copy, $0.95 in microfiche. Louisiana Water esources Research Institute Bulletin No 6, Oc-ber 1970. 90 p, 9 fig, 3 tab, 7 ref, append. OWRR roject A-020-LA (1).

escriptors: *Groundwater, *Land subsidence, Water levels, Bench marks, Withdrawal, Ground-ater mining, Louisiana, Subsidence, Aquifers, quifer characteristics.
dentifiers: Baton Rouge (La).

recise leveling in the Baton Rouge area during the mmer of 1969 showed that the land is subsiding a variable rate because of groundwater offtake. etween 1964 and 1969, the surface in the heart of ie industrial area had sunk 1.3 feet. A map with ontour lines of equal subsidence, together with aps of groundwater elevations in the principal quifers, shows a cause-effect relation. In each of vo instances, an isolated area of subsidence out-de the principal center of pumping coincides with ie location of an individual well field. Additional ubsidence of at least 0.4 feet will occur by 1974. If ie net offtake from the deep aquifers is not educed at once, through the importation of water nd the artificial recharge and subsequent utiliza-on of the shallow aquifers, the total maximum ubsidence in the center of the industrial area could each 5 feet or more by 1990. The study also in-icated that the Baton Rouge fault is active, with ie downthrown (south) side dropping at max-num rate of about 0.02 feet per year. The appen-ix contains descriptions of the 116 benchmarks sed in the leveling survey. (Kazmann-LSU)
71-02828

THE GEOLOGICAL AND HYDROLOGICAL CHARACTERISTICS OF THE WHITEWATER AREA, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
Frank Byrne.
Available from NTIS as PB-196 366, $3.00 in paper copy, $0.95 in microfiche. Wisconsin University Water Resources Center Technical Report, 1970. 86 p, 24 fig, 7 plate, 4 tab, 19 ref. OWRR Project A-013-WIS (1).

Descriptors: *Groundwater, *Geologic investigations, *Hydrologic data, *Water quality, *Wisconsin, Aquifers, Water table, Water levels, Hydrogeology, Drill holes, Water yield, Wells, Geology, Data collections.
Identifiers: *Whitewater area (Wis).

In the Whitewater, Wisconsin area, a study was made of the groundwater hydrology and the geologic factors that influence it. The unconfined groundwater under the eastern part of the Whitewater area is in the Mayville dolomite and Quaternary sediments above the shales of the Maquoketa formation. The confined 'artesian' water of the Zone of Saturation is that water confined to the permeable formations from the Cambrian Mt. Simon sandstone to the Ordovican Galena-Platteville formations. The gradient of the water table is steepest just within the crest of the Whitewater sub-basin divide. In this mile-wide zone the average slope is toward the center of the basin at about 25 feet a mile. Wells in glacial outwash deposits have limited yields and this aquifer is generally best suited to farm supply. The Mayville dolomite is adequate when moderate quantities of water are required but is not capable of major contributions to municipal or industrial supply. The Galena-Platteville unit, because of its closeness to the surface within the Whitewater sub-basin, is a most important source of water for rural supply. The most important reservoirs of groundwater for safe yield in relatively large quantities are the sandstones of the Cambrian system, especially the Mt. Simon sandstone. The average chemical composition of the waters from the local aquifers exhibit strong secondary alkalinity. This is indicative of the effect of beds of dolomite on the infiltrating groundwaters. Only the waters in the Quaternary glacial outwash and the Mayville dolomite show marked deviation from this characteristic. (Woodard-USGS)
W71-02882

SHORT PERIOD VARIATION IN LAND SUBSIDENCE,
Tokyo, Japan.
A. Isigaki, Shauzow Komaki, Takeshi Endo, and Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 325-333, 1970. 9 p, 7 fig, 2 tab, 2 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water level fluctuations, Hydrogeology.
Identifiers: Tokyo (Japan).

On the records of compaction obtained at several stations in and near Tokyo, fluctuations with nearly diurnal and semidiurnal periods are superimposed on secular advancement of subsidence. These short period fluctuations were analyzed by taking deviations from the 24 hours' moving averages of the hourly values of compaction. The diurnal change is characterized by particularly remarkable daytime swelling of surface soil layer. The swelling of the soil layer appears to be very nearly parallel to the change in barometric pressures and to change in the groundwater level, slightly out of phase (with a lag of 2-3 hours). The terms of tidal changes were also taken out, although the amplitude is far less than that of the diurnal fluctuations. (Knapp-USGS)
W71-02906

ON THE INFLUENCE OF OCEANIC TIDES UPON ARTESIAN HEAD AND SURFACE LEVEL OF LAND,
Saitama Univ., Urawa (Japan). Dept. of Science and Technology.
Shauzow Komaki.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 334-342, 1970. 9 p, 1 fig, 6 tab, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water level fluctuations, Tidal effects, Tides, Confined water.
Identifiers: Yokkaichi (Japan).

In observations of artesian head and subsidence in and near Yokkaichi, diurnal and semi-diurnal period fluctuations are superposed upon secular variations. After eliminating secular variations, the hourly values of artesian head and land surface were harmonically analyzed by the method of least squares. Similarities of the values in phase lag between oceanic tides and artesian head are found in individual wells. Relations are found between oceanic tides and land surface, somewhate similar. (Knapp-USGS)
W71-02907

PROGRESS REPORT ON GROUNDWATER INVESTIGATION IN IRAN,
Ministry of Water and Power, Tehran (Iran). Div. of Groundwater.
A. Massomi.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 29-31, January 1970. 3 p.

Descriptors: *Groundwater, *Water resources, *Hydrogeology, *Foreign projects, *Programs, Planning, Water analysis, Bench marks, Gaging stations, Observation wells, Hydrologic data, Meteorological data, Groundwater basins, Subsurface investigations.
Identifiers: *Iran, Project activities, Meteorological stations, Scarce data, Ghanats.

The Government of Iran began considering the problem of groundwater development in 1943, with the creation of the Independent Irrigation Corporation. This report lists a summary of work carried out by the Corporation and ministerial staff and consulting firms from 1958 to January 1969 of 27 regions covering a total area of more than 60,000 square kilometers and reconnaissance survey of 33 other regions. Future programs of the Groundwater Division within the Fourth Development Plan of Iran are listed. Since 1958 investigations have been made of about 8,000 ghanats (gravity flow galleries), 5,500 deep wells, 13,000 shallow wells, and 1,750 springs. About 450 exploratory wells, 6 to 16 in in dia and totaling more than 60,000 m in footage, were drilled, developed, and tested by step drawdown, recovery and interference methods. Also 650 observation wells were drilled and 1,600 privately-owned wells were used for observation of water level changes. The installation of 30 meteorological and 75 stream gaging stations were installed for support of the groundwater studies. Geochemical analyses of 15,000 samples from wells, ghanats and springs were made during the 6 yr since 1963. Future program calls for completion of studies in 2 regions, reconnaissance of 50 alluvial filled basins, determination of groundwater potential in the Karst region of the Zagros Mountains, among other projects. (Lang-USGS)
W71-02913

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS, 1965-70,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 07C.
W71-02921

GEOHYDROLOGY OF FINNEY COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Washington, D.C.
Walter R. Meyer, Edwin D. Gutentag, and David H. Lobmeyer.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402. Geological Survey Water-Supply Paper 1891, 1970. 117 p, 51 fig, 2 plate, 8 tab, 51 ref.

Descriptors: *Hydrogeology, *Aquifers, *Hydrologic budget, *Hydrologic data, *Kansas, Surveys, Data collections, Aquifers, Water resources development, Water levels, Withdrawal, Alluvium, Water quality, Water yield, Irrigation water, Water balance, Recharge.
Identifiers: Finney County (Kans).

In Finney County, southwestern Kansas, the spatial relationships of the subsurface deposits were determined from more than 1,400 sample, drillers', gamma-ray, and laterolog resistivity logs of rotary test holes. The log data were used for lithology of the rock samples, topography of the pre-Pliocene surface, bedrock geology, regional structure, and geologic sections. Unconsolidated sediments of Tertiary and Quaternary age form the principal groundwater reservoir of Finney County and attain a thickness of more than 500 feet in the southwestern part of the county. Recharge to the Tertiary and Quaternary aquifers is principally from dune-sand areas, depressions in the loess, and irrigated areas. Recharge to alluvial deposits is from the Arkansas River, local precipitation, and underflow from the dune sand. The annual recharge averaged approximately 177,000 acre-feet for the period 1955-64. The 1963 rate of pumping was approximately 295,000 acre-feet. The pumping rate caused an overdraft on the reservoir of approximately 167,000 acre-feet. This caused an average drop in water level of 1.5 feet. Water in about half the area is undesirable for domestic purposes because of dissolved-solids content or high fluoride concentrations. (Knapp-USGS)
W71-02923

THE TWICE-USED WATER,
Tor Eigeland.
Aramco World Magazine, November-December 1970, Vol 21, No 6, p 22-29. 28 photos.

Descriptors: *Water reuse, *Irrigation water, *Salinity, *Drainage, Construction, Consumptive use, Saline water, Irrigation practices, Irrigation systems, Sands, Dates, Vegetable crops, Grains (Crops), Irrigated lands, Springs, Artesian wells, Winds, Cultivated lands, Silting, Fresh water, Dunes, Drainage systems, Evaporation, Leaching, Canals, Groundwater, Salt marshes, Channels, Costs, Projects, Withdrawal, Arid lands, Agriculture, Social impact.
Identifiers: *Oases, *Al-Hasa, *Saudi Arabia, Irrigated crops, Dune control, Evaporation lakes.

Twice-used water refers to the saline spring waters of the huge, ancient oasis of al-Hasa in the Eastern Province of Saudi Arabia, 40 miles west of the Arabian Gulf. As this water is reused by farmers for irrigation when it moves from field to field, the crop-killing salinity increases. This oasis--the largest in Saudi Arabia--is an L-shaped collection of many villages and 3 sizeable towns totaling more than 160,000 people. While quality dates have been grown since ancient times, vegetables and grains are now being producted as well. Irrigation water in this rainless area comes from springs and artesian wells and is directed through sluices. Groundwater is pumped from 30 springs at a rate of 237,800 gal/min. Recently, winds have been blasting sand into cultivated areas, driving people out, blocking ancient drainage canals, silting more than 100 freshwater springs, creating salty swamps and covering fertile soil with waves of sand. Dune control techniques, a forestry program, construction of surface and underground drainage channels leading to huge evaporation lakes, a new irrigation system and extensive leaching and fertilization have improved the agricultural situation. A $51 million project is described in which 20,000 ha. were put under irrigation requiring 900 miles each of concrete canals and ditches, 1000 miles of roads and 155 German and 2,200 Saudi workers. Construction is more than 80 percent complete. (Popkin-Arizona)
W71-02959

HYDROLOGY OF LIMESTONE TERRANES - GEOPHYSICAL INVESTIGATIONS,
Geological Survey of Alabama, University.
Thomas J. Joiner, and W. Leon Scarbrough.
Geological Survey of Alabama Bulletin 94, Part D, 1969. 43 p, 23 fig, 9 plate, 100 ref. OWRR B-007-ALA (2).

Descriptors: *Hydrogeology, *Karst, *Geophysics, *Surveys, Electrical studies, Gravity studies, Groundwater movement, Limestones, Fractures (Geology).
Identifiers: Limestone hydrology.

Geophysical methods can sometimes be used successfully to assist in locating, defining, and projecting general trends of solution development in limestone terranes. Geophysical anomalies which can be used as guides for test drilling are: (1) areas where a thick cover of residuum is indicated by seismic surveys; (2) areas where seismic data indicate slower-than-normal bedrock velocities; (3) areas where conductive anomalies are detected within the bedrock by 'horizontal-type' electrical resistivity surveys, and (4) areas where gravity data indicate isolated 'minima' and trends of lower-than-normal gravity values. Reconnaissance geophysical surveys can be used to eliminate unfavorable areas and to indicate areas where efforts of other disciplines should be concentrated. (Knapp-USGS)
W71-03017

HYDROLOGY OF LIMESTONE TERRANES - ANNOTATED BIBLIOGRAPHY OF CARBONATE ROCKS,
Alabama Geological Survey, University.
Philip E. LaMoreaux, Dorothy Raymond, and Thomas J. Joiner.
Copies of this bulletin can be obtained from Librarian, Geological Survey of Alabama, PO Drawer O, University, Alabama 35486. Alabama Geological Survey Bulletin 94, Part A, 1970. 242 p, 2 tab, 462 ref. OWRR Project B-007-ALA (1).

Descriptors: *Bibliographies, *Hydrogeology, *Limestones, *Karst, *Abstracts, *Information retrieval, Groundwater movement, Water chemistry, Water resources, Hydrology, Geochemistry, Geology, Geomorphology, Geophysics, Remote sensing.
Identifiers: *Limestone hydrology.

This annotated bibliography of carbonate rocks was prepared to fill a need for a special compilation. Limestone and dolomite occupy roughly one-fifth of the area of the earth and, in places, contain large quantities of groundwater, petroleum and natural gas, and valuable reserves of metals. This bibliography is composed of references to the geology, the hydrology, the geochemistry, and the geophysics of carbonate rocks and to selected closely related subjects. Citations are listed alphabetically by principal author and numerically by document numbers. The Subject Index contains a two-level term set following a system devised by the Geological Survey of Alabama. The Location Index is by individual states of the United States and by country. Each index lists the citations by document number. The references are also stored using an IBM 360 Model 50 computer. This stored information is available through application to the Geological Survey of Alabama. The computer is also programmed to retrieve citations by geological age. Each reference is encoded numerically under the subject, the geographic location, the geologic age, and description codes, as well as by author and date of publication. (See also W71-03017). (Knapp-USGS)
W71-03109

NITRATE AND AMMONIUM CONTENTS OF WISCONSIN LIMESTONES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W71-03111

WATER IN MARYLAND: A REVIEW OF THE FREE STATE'S LIQUID ASSETS,
Geological Survey, Towson, Md.
For primary bibliographic entry see Field 02E.
W71-03117

WATER RESOURCES AND RELATED GEOLOGY OF DERA ISMAIL KHAN DISTRICT, WEST PAKISTAN, WITH REFERENCE TO THE AVAILABILITY OF GROUNDWATER FOR DEVELOPMENT,
Geological Survey, Washington, D.C.
James W. Hood, Lutfe Ali Khan, and Khalid Jawaid.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Geological Survey Water-Supply Paper 1608-K, 1970. 74 p, 16 fig, 6 plate, 10 tab, 20 ref.

Descriptors: *Water resources development, *Irrigation water, *Hydrogeology, Water balance, Aquifers, Alluvium, Water quality, Data collections, Hydrologic data, Surface waters, Streamflow, Water yield, Water wells.
Identifiers: *Pakistan, *Dera Ismail Khan (Pakistan).

Dera Ismail (D.I.) Khan District contains an area of 3,450 square miles between the right bank of the Indus River and the Sulaiman Range in west-central West Pakistan. The region is semiarid with an average annual rainfall of about 9 inches and a potential evapotranspiration rate of eight to nine times the annual rainfall. D.I. Khan District is primarily an alluvial plain. Indus River alluvium penetrated by test holes and tubewells consists predominantly of sand, which in tubewells can yield from 2 to 3 cfs of water with only moderate drawdown. Also in this belt, groundwater of good chemical quality extends to depths of 1,000 feet or more. The area from the mouth of the Gumal River gorge to the vicinity of Kot Azam contains sand and gravel strata that may yield from 1 to 3 cfs of water, which contains 500 to 1,500 ppm of total dissolved solids. The central part of the District contains highly mineralized water and few aquifers. Under present conditions, surface-water supplies are fully utilized, and groundwater is the largest supply available for development. (Knapp-USGS)
W71-03132

GROUNDWATER ANALOGUES,
Melbourne Univ., Parkville (Australia). Dept. of Agricultural Engineering.
J. D. Lawson, and A. K. Turner.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 7, p 106-124, April 1970. 19 p, 24 ref.

Descriptors: *Mathematical models, *Analog models, *Groundwater movement, *Computer models, *Hydraulic models, Reviews, Model studies, Digital computers, Analog computers, Simulation analysis, Drawdown, Pumping, Water yield, Water wells, Withdrawal, Aquifers.
Identifiers: Groundwater modeling.

Hydraulic models and computer models for solving groundwater movement problems are reviewed. In general, mathematical solutions of groundwater flow regions are impossible due to the complexity of the governing field equation and the usually complicated boundaries of the region to be analyzed. However, with the present availability of high speed, large storage digital computers, numerical solutions of flow fields are readily attainable. Electrical-network analogs can be used to model both confined and unconfined groundwater systems. Aquifer properties and boundary parameters can be electrically simulated and varied, and function generators are available to provide the effects of discharge and recharge wells, spreading grounds, springs, and net infiltration from rainfall in aquifers of varying transmissibility. Three different types of analog discussed in detail are membrane electrical network, and Hele-Shaw analogs. (Knapp-USGS)
W71-03135

WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 04B.
W71-03136

HYDROGEOLOGIC ELECTRIC ANALOGUE MODELS CONSTRUCTED BY THE SOUTH AUSTRALIAN MINES DEPARTMENT,
South Australia Dept. of Mines.
D. McPharlin.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 8, p 125-132, April 1970. 8 p, 1 ref.

Descriptors: *Analog models, *Resistance networks, Computer models, Water resources development, Model studies, Water yield, Water management (Applied), Irrigation water.
Identifiers: *Australia.

Analog models are a useful aid to hydrogeology studies in Australia. The Adelaide Plains Model and two additional studies of areas of South Australia which contain major water resources are discussed. The models are constructed of discrete resistors and capacitors assembled in a regular network on a pegboard base. The resistors are selected so that their values are inversely proportional to the transmissivity of the portion of the aquifer they represent. Once these conditions have been satisfied the choice of time scale for the model fixes the size of the capacitor which must be used at each resistor junction to produce the electrical equivalent of storage factor. (Knapp-USGS)
W71-03137

DIGITAL MODELS IN REGIONAL GROUNDWATER STUDIES,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
D. H. Pilgrim.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 9, p 133-151, April 1970. 19 p, 4 fig, 37 ref.

Descriptors: *Model studies, *Groundwater movement, *Digital computers, *Analog models, *Reviews, Water resources development, Hydrogeology, Simulation analysis.
Identifiers: *Australia.

Digital models have been developed for analysis and simulation of groundwater flow. The general approach and computational procedures used in these models are outlined, and applications are reviewed. Comparison of the digital and electric analog methods shows that digital models have several advantages, and that these should be enhanced by future developments. More widespread observation well records are desirable if digital models are to be applied in Australia. (Knapp-USGS)
W71-03138

SYSTEM MODELLING FOR CONJUNCTIVE USE OF A GROUNDWATER AQUIFER AND A SURFACE RESERVOIR,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 04B.
W71-03139

LAND SUBSIDENCE; PROCEEDINGS OF THE TOKYO SYMPOSIUM, SEPTEMBER 1969.

International Association of Scientific Hydrology, Tokyo, 1970. 2 volumes.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Soil water, Soil water movement, Hydrogeology, Clays, Rheology.
Identifiers: *Japan.

The problems of land subsidence are discussed in symposium proceedings of 67 papers. These phenomena have had what may be called catastrophic results. Although no limit had been placed upon the type of subsidence to be studied, most of the Japanese and American authors paid particular attention to subsidence caused by the lowering of water-tables or by the exploitation of oil fields. Theory has advanced very far in these spheres, thanks to study of the compaction of strata, considered as a mechanical problem. Some of the papers, however, attributed land subsidence to other causes, such as the dissolution of limestone deposits, the working of mines, or purely tectonic movements. The influence of soil components (sand, clay, loess, peat, etc.) interested some researchers. The action of hurricanes and tides was also considered, particularly by Japanese specialists. A number of contributions were confined to the effects of subsidence upon surface and subsoil hydrology, irrespective of its causes. Appropriate means of reducing subsidence were considered. (See also W71-03149 thru W71-03182) (Knapp-USGS)
W71-03148

DIRECTIONS OF RESEARCH ON LAND SUBSIDENCE,
Komazawa Univ., Tokyo (Japan).
Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 1-11, 1970. 11 p, 8 fig, 11 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Soil water, Soil water movement, Hydrogeology, Clays, Rheology.
Identifiers: *Japan.

Investigations of land subsidence are reviewed and further research on this subject is recommended: (1) to develop laboratory experiments on models and analogs; (2) to extend chemical and mineralogical analyses of soil; (3) to extend hydrological studies on aquifers underneath wider areas including land subsidence areas; and (4) to extend studies on the compaction of deep seated soil layers. The results of advanced studies will be more help in designing preventive measures against land subsidence. (See also W71-03148) (Knapp-USGS)
W71-03149

STATUS OF PRESENT KNOWLEDGE AND NEEDS FOR ADDITIONAL RESEARCH ON COMPACTION OF AQUIFER SYSTEMS,
Geological Survey, Sacramento, Calif.
J. F. Poland.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 11-21, 1970. 11 p, 2 fig, 1 tab, 29 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Mathematical models, Soil water movement, Hydraulic conductivity.
Identifiers: Aquifer systems.

The deposits that are compacting in many areas of major subsidence are relatively unconsolidated, chiefly alluvial and lacustrine sediments, of late Cenozoic age, in confined aquifer systems of heterogeneous texture. Parameters needed to predict compaction include compressibility, initial stress, change in stress, number and thickness of compressible beds, and vertical hydraulic conductivity. Compaction is computed from laboratory test results on cores, or derived for the entire aquifer system from field stress-strain relations. Methods used to measure compaction (or expansion) of sediments include bench-marks, extensometers, periodic casing-collar logging, and periodic measurement of emplaced radioactive bullets. Additional research is needed on the effect of multi-cyclic loading, improvement of field methods for determining compressibility of aquifer systems, measuring compaction and pore pressures, estimating preconsolidation loads, and development of mathematical and electronic models capable of simulating compaction of confined aquifer systems. (See also W71-03148) (Knapp-USGS)
W71-03150

LAND SUBSIDENCE PROBLEMS IN TAIPEI BASIN,
Jui-Ming Hwang, and Chian-Min Wu.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 21-34. 14 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Taiwan.

Releveling of bench marks in 1968 and 1969 indicates that subsidence of the land surface in the Taipei Basin, Taiwan is more than 1.3 meters. In the sharp subsidence area, subsidence which was as much as 0.6 meter in 1966 now has about doubled. The maximum rate of subsidence in recent years was about 25 cm a year. Plots of subsidence against decline in artesian pressure suggest that pressure decline is a major cause of the subsidence. Consolidation data are used to verify the relationship between the pressure drop and the subsidence. However, other causes such as compaction of soil, tectonic adjustment and loading at land surface may have contributed to the subsidence. (See also W71-03148) (Knapp-USGS)
W71-03151

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, Tex.
Robert K. Gabrysch.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 43-54, 1970. 12 p, 9 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Houston (Tex), *Galveston (Tex).

In the Houston-Galveston region of Texas, the principal cause of land-surface subsidence is the lowering of pressure heads due to the removal of water and oil from subsurface strata. This paper emphasizes the effects of removal of water. The region is underlain by a thick section of unconsolidated lenticular deposits of sand and clay. Clays separating beds of sand retard the vertical movement of water, creating artesian conditions within the aquifers. The ration of sand to clay, which is a major factor controlling the degree of compaction, varies from place to place in the aquifers. Reduction of pressure due to withdrawal of water causes additional load to be transferred to the skeleton of the aquifer system, causing compaction. As much as 5 feet of subsidence occurred in the Houston-Galveston region between 1943 and 1964, and as much as 200 feet of water-level decline occurred during the same period. The rate of subsidence increased from about 0.2 foot per year during the 1954-59 to about 0.24 foot per year during the 1959-64 period. The decline in water levels increased from about 4 feet per year to about 7 feet per year in those same periods. (See also W71-03148) (Knapp-USGS)
W71-03152

SURFACE DEFORMATION ASSOCIATED WITH OIL AND GAS FIELD OPERATIONS IN THE UNITED STATES,
Geological Survey, Menlo Park, Calif.
R. F. Yerkes, and R. O. Castle.
Partial support by U S Atomic Energy Comm. In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 55-66, 1970. 12 p, 6 fig, 1 tab, 15 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, Aquifers, Oil wells, Oil reservoirs, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Faults (Geology), Fractures (Geology).
Identifiers: *Salt domes, *Oil-field subsidence.

Surface deformation associated with oil and gas field operations in the United States consists of (1) differential subsidence centering on the fields, (2) centripetally directed horizontal displacements, and (3) faulting. Faulting is commonly high-angle, normal, and peripheral to the subsidence bowl (Goose Creek and Mykawa, Texas; Inglewood and Kern Front, California), but may be low-angle, reverse, and central Buena Vista, California). Strain patterns developed over these fields are similar to those over a Texas salt dome where all three surface effects were observed during Frasch extraction of sulfur. In this case, a central compressional zone extended out to beyond the 0.35 S isobase (S — maximum subsidence) and a surrounding tensional zone extended to the periphery of the bowl, where high-angle normal faulting occurred. (See also W71-03148) (Knapp-USGS)
W71-03153

SUBSIDENCE IN THE WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.,
Long Beach Dept. of Oil Properties, Calif.
M. N. Mayuga, and D. R. Allen.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, pp 66-79, 1970. 14 p, 16 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, Aquifers, Oil wells, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Injection wells, Injection, Secondary recovery (Oil), Injection wells.
Identifiers: *Wilmington Oil Field (Calif), *Oil-field subsidence.

The Long Beach subsidence area, California, is an elliptical bowl superimposed on top of California's largest oil giant, the Wilmington Oil Field. The center of the bowl has subsided over 9 meters since 1926. Horizontal and vertical movements have caused extensive damage to wharves, pipelines, buildings, streets, bridges and oil wells, necessitating costly repairs and remedial work, including the raising of land surface areas to prevent inundation by the sea. Remedial costs have already exceeded US$100 million. Withdrawal of fluids and gas and the consequent reduction of subsurface pressures in the reservoirs caused compaction in the oil zones. A massive repressurization program, by injection of salt water into the oil reservoirs, reduced the subsidence area from approximately 50 sq. kilometers to 8 sq. kilometers. The rate of subsidence at the historic center of the bowl was reduced from a maximum of 75 cm per year in 1952 to 0.0 cm in 1968. A small surface rebound occurred in areas of heaviest water injection. (See also W71-03148) (Knapp-USGS)
W71-03154

LAND SUBSIDENCE IN THE TOKYO DELTAIC PLAIN,
Tokyo Metropolitan Univ. (Japan). Dept. of Science and Engineering.
Takamasa Nakano, Hiroshi Radomura, and Tware Matsuda.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 80-87, 1970. 8 p, 5 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Tokyo (Japan).

Land subsidence in Tokyo has been caused mainly by the compaction of soft clayey layers within aquifers subject to over-pumping of groundwater. Compaction is progressing not only in Alluvium, but also in Diluvium. The amount of land subsidence is the sum of compaction of alluvium and of the layers below alluvium. The relationship between the amount of land subsidence and thickness of Alluvium is clear, particularly in the case of land subsidence due to pumping of groundwater from alluvium and upper diluvium. (See also W71-03148) (Knapp-USGS)
W71-03155

REVIEWS OF LAND SUBSIDENCE RESEARCHES IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan).
Yoshi Inaba, Iwao Abe, Susumu Iwasaki, Shigeru Aoki, and Takeshi Endo.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 87-98, 1970. 12 p, 8 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Tokyo (Japan).

Land subsidence in the lowland of Tokyo was discovered as a result of repeated precise levelling in 1924 to study the post-seismic crustal disturbance associated with the Kwanto Earthquake of 1923. This paper is a historical review of the progress of the land subsidence phenomena in Tokyo. Recently, in spite of control of groundwater withdrawalland subsidence and overall-lowering of the groundwater table have continued, and the area of subsidence has been extending towards surrounding lowland and upland areas. Lower pleistocene deposits which contain abundant confined water are widely distributed within the large sedimentary basin of the southern Kwanto region. Removal of groundwater in these deposits has a close relationship with the land subsidence. (See also W71-03148) (Knapp-USGS)
W71-03156

RESULTS OF REPEATED PRECISE LEVELLINGS IN LAND SUBSIDENCE AREA IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ. (Tokyo).
Susumu Iwasaki, Ryozo Kaido, and Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 98-105, 1970. 8 p, 6 fig, 2 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Tokyo (Japan).

The amounts of land subsidence in the Koto region of Tokyo have been measured once a year by repeating precise levelling. The gradual expansion of the subsidence area was studied by analogy with the phenomenon of diffusion. The local values of constants D, analogs to the diffusion constant, are calculated and their distributions are examined. As a result, the distribution of D thus obtained may be regarded as some indication of underground hydrogeological structures which are closely related to the occurrence of land subsidence. One of the parameters considered as the controlling factor is the permeability of the aquifer, multiplied by the gradient of groundwater pressure, which describes the lateral flow of groundwater according to Darcy's law. The distribution of D may therefore be some indication of the distribution of the groundwater flow or distribution of the permeability within the aquifer concerned. (See also W71-03148) (Knapp-USGS)
W71-03157

LAND SUBSIDENCE IN OSAKA,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
S. Murayama.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 105-130, 1970. 26 p, 5 fig, 4 tab, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Osaka (Japan).

One of the typical examples of land subsidence in Japan can be seen in Osaka city, where the maximum subsidence amounts to about 2.5 m during the last 25 years. Such remarkable ground subsidence is due mainly to the consolidation of clay strata caused by decrease in the artesian pressure. There was a close correspondence between the level of groundwater and the actual rate of subsidence. When the water level recovered, the subsidence became slight and sometimes it stopped. The distribution of pre-consolidation pressure in the normally consolidated alluvial clay in Osaka follows the decrease in the artesian head in the aquifer. (See also W71-03148) (Knapp-USGS)

W71-03158

ANALYSIS OF LAND SUBSIDENCE IN NIIGATA,
Ministry of Transportation, Yokosuka (Japan). Port and Harbor Research Inst.
Tatsuro Okumura.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 130-143, 1970. 14 p, 8 fig, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Natural gas, Hydrogeology.
Identifiers: *Niigata (Japan).

Land subsidence in the Niigata area of Japan was analyzed by means of consolidation theory. Pumping the underground water from the deep sandy layers for extracting methane gas caused a time-dependent loading of the clay layers. An analytical solution of consolidation under the load increasing linearly with time was obtained in terms of the vertical strain. A numerical method of analysis for the load decreasing linearly and then becoming constant was developed considering the difference in values of soil constants for consolidation and for rebound. These two methods were combined for analyzing the subsidence in the Niigata area, and the results compared favorably with the observed settlement. (See also W71-03148) (Knapp-USGS)
W71-03159

TRITIUM DATING OF LAND SUBSIDENCE IN NIIGATA,
Shigehiko Kimura, Masayuki Wada, Hironao Kawasaki, and Hisoshi Shiina.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 185-192, 1970. 8 p, 5 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Radioactive dating, Tritium, Groundwater.
Identifiers: *Niigata (Japan).

In order to know the influence of the pumping of groundwater on land subsidence in the Niigata area, an accurate evaluation of the groundwater flow in the area is required. The tritium dating method was applied to the evaluation. The groundwater flow into the area and the characteristics of the groundwater flow within the area were clarified. The results have given information for establishing models of the land subsidence from the viewpoint of both hydraulics and soil engineering. This method, when applied to a longer period, was proved to be an appropriate technique for not only a more detailed indication of groundwater flow, but also the quantitative estimation of the changes of the flow in the future, based on the quantitative groundwater flow and the results of hydraulic computation. Natural gas dissolved in water in the Alluvium, 40 to 150 m in depth, enclosed by an impervious bed as thick as 20 m, is removed along with water. The pumped water is derived from (1) the groundwater flow of about 2 km/year from the upstream side, (2) the inflow from its underlier, and (3) lateral flow and infiltration of rain water. (See also W71-03148) (Knapp-USGS)
W71-03160

SHRINKAGE OF SUBAQUEOUS SEDIMENTS OF LAKE IJSSEL (THE NETHERLANDS) AFTER RECLAMATION,
Yssel Lake Development Authority, Kampen (Netherlands).
R. J. de Glopper.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 192-201, 1970. 10 p, 4 fig, 6 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Drying, Drainage engineering, Land reclamation.
Identifiers: *Lake IJssel (Netherlands), *Polders.

The very soft subaqueous sediments on the bottom of Lake IJssel are subject to a considerable shrinkage after reclamation. This is brought about by a contraction of the soil, mainly due to high capillary potentials during the growing season. The prediction is done by comparing the specific volumes of the original sediments with samples of the same type of sediments, which were reclaimed about 100 years ago. Shrinkage increases with increasing clay content and decreases with increasing depth of the layer concerned. A graph shows the relation between the original thickness of the soft layers and 100 years after reclamation at clay contents varying from 5 to 60% and at intervals of 5%. (See also W71-03148) (Knapp-USGS)
W71-03161

THE HYDROLOGIC BALANCE IN THE LAND SUBSIDENCE PHENOMENA,
Research Inst. for Natural Resources, Tokyo (Japan); Kokusai Aerial Surveys Co. Ltd., Tokyo (Japan); and Tokyo Univ. (Japan). Dept. of Engineering.
Tatsuo Shibasaki, A. Kamata, and Shizuo Shindo.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 201-215, 1970. 15 p, 13 fig.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

The hydrologic balance in confined grounwater basins was studied in the land subsidence areas in Japan. The results of computations show that the leakage is estimated to be about 60 to 70% of the total recharge to the basin. These values of leakage ratios will be useful in solving the problems in the land subsidence area. Samples of confined groundwater were taken for tritium analysis. The tritium content of samples ranged from 0.2 to 0.3 T. U., indicated apparently a poor recharge from the outcrop area to the basin. (See also W71-03148) (Knapp-USGS)
W71-03162

NIIGATA GROUND SUBSIDENCE AND GROUNDWATER CHANGE,
Takuzo Hirono.
In: Proceedings of the Tokyo Symposiun on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 144-161, 1970. 18 p, 13 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Natural gas, Hydrogeology.
Identifiers: *Niigata (Japan).

Periodogram and Fourier analysis were applied to the data obtained from observation wells installed for measuring ground subsidence at Yamanoshita ward, Niigata City, Japan in 1958. The items of data analyzed are the sea level at the harbor and the atmospheric pressure at the meteorological observatory in addition to the ground subsidence and the groundwater level at the observation wells. The analyses were made for the period from July to October, 1958 (about 120 days). The ground surface changes periodically with the groundwater. For shorter periods (less than 30 days) the ground surface undulates with amplitude proportional to that of the groundwater without any significant phase-lag. The longer the period (over 100 days), the later becomes the motion of the ground with respect to the groundwater, up to 90 deg out of phase. The permeability of the soil is inversely proportional to the period. (See also W71-03148) (Knapp-USGS)
W71-03163

SUBSIDENCE IN THE NORTH GERMAN COASTAL REGION,
R. Dolezal, and M. Petersen.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 35-42, 1970. 8 p, 9 fig, 12 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Surveys.
Identifiers: *Germany.

Subsidence was measured in Holocene sea- and river-marshes blocked by dykes against floods of sea water and brackish river water. The soils of the sea marshes consist mainly of pure sand and more or less organic components (silt and clay). In the river marshes organic components (bog and peat) predominate. Fixed pipe supports and plates free to move with subsidence are used to measure settlement. The pipes are inserted through the Holocene stratum into the pleistocene. Near the fixed pipes, plates are located 25 centimeters below the land surface. Each year the height of the fixed pipe and the relative level of the plates is determined. Graphs of the relative height with time indicate the progress of the settlement. These measurements are complemented by observing the groundwater level. (See also W71-03148) (Knapp-USGS)
W71-03164

A LINEAR RELATIONSHIP BETWEEN LIQUID PRODUCTION AND OIL-FIELD SUBSIDENCE,
Geological Survey, Menlo Park.
R. O. Castle, R. F. Yerkes, and F. S. Riley.
Partial support for this study was provided by the Div of Reactor Development and Technology, U S Atomic Energy Comm. In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 1, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 162-173, 1970. 12 p, 6 fig, 9 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, Aquifers, Oil reservoirs, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Oil wells.
Identifiers: *Oil-field subsidence.

Correlations between production and subsidence in the Inglewood oil field of California indicate that subsidence has varied approximately linearly with net liquid production. Similar relations in three Venezuelan fields and the Wilmington and Huntington Beach fields in California, suggest that this linearity may be a general phenomenon. The ratio of volume of subsidence to volume of liquid production ranges from 0.08 in the Inglewood field to nearly 1 in one Venezuelan field. Early production stages commonly have been characterized by non-linearity. If compaction is considered a linear function of effective stress over the relevant stress range, simple analogy with a tightly confined arte-

sian system (where production must derive from liquid expansion and/or reservoir compaction) indicates that the ratio should remain: (1) constant and close to zero for those fields characterized by slightly compressible reservoir materials; and (2) constant and close to but less than 1 for those fields characterized by highly compressible reservoir materials. Changes in the ratio through time may be related to changes in the produced gas/liquid ratio. (See also W71-03148) (Knapp-USGS)
W71-03165

EFFECTS OF MINING SUBSIDENCES ON THE GROUNDWATER AND REMEDIAL MEASURES,
Bochum Univ. (West Germany).
B. Wohlrab.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 502-512, 1970. 11 p, 10 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Drainage engineering, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Drainage systems.
Identifiers: *Germany.

Mining subsidence in Germany have an important influence on the water cycle and on the cultivation of land. In addition to flooding, other components of ground movements also disorder water utilization directly or indirectly. Elongations, compressions, displacements and subsidence slope are a disadvantage for hydraulic engineering, as well as for drainage and irrigation works. An artificially created drainage of water and a suitable groundwater level for the subsidence area can be successful in the long run only if the ground movements stop. If ground movements continue, a pumping station is necessary. In spite of the artificially created flow of water, with or without a pumping station, drainage of subsidence troughs will remain difficult so long as ground movements go on. (See also W71-03148) (Knapp-USGS)
W71-03166

SURFACE SUBSIDENCE AND SINKHOLES IN THE DOLOMITIC AREAS OF THE FAR WEST RAND, TRANSVAAL, REPUBLIC OF SOUTH AFRICA,
Dept. of Mines, Johannesburg (South Africa); and Geological Survey, Pretoria (South Africa).
C. A. Bezuidenhout, and J. F. Enslin.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 482-495, 1970. 14 p, 8 fig, 4 plate, 10 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Dolomites, Limestones, Gold.
Identifiers: *South Africa.

The gold-bearing reefs of the Far West Rand underlie 1,200 meters of dolomite, the most important aquifer of the Republic of South Africa. The groundwater is stored in separate dike bounded compartments (a typical one covers 160 square kilometers and has a storage capacity of 700,000 megaliters and flows into the mine workings at enormous rates, depending on the number of post-dolomite faults cutting the workings and the hydrological characteristics of those faults. The dolomitic groundwater compartments are dewatered by pumping and the disposal of the pumped water in such a way that it cannot return to the pumped compartment and recirculate through the mines. Dewatering, however, results in differtial subsidence of large areas and the formation of sinkholes; certain areas have thus become unsafe for occupation. Sinkholes form concurrently with the lowering of the water table in areas which had been free from sinkholes before. These areas fall under three groups: (1) Those where the original water table was less than 15 meters below, and less frequently within 30 meters of the surface. (2) The scarp zones bordering on the deep valleys. (3) In narrow valleys, i.e. valleys which are deeper than they are wide. Valleys which are more than 100 meters wide can still be classified as narrow valleys if they narrow down at great depth to a width which permits blockage and bridging of the unconsolidated material to occur. The bridge will be weakened and may collapse when dewatering takes place. A gravity method of delineating areas of potential subsidence and zones where the conditions are favorable for the formation of sinkholes id described. (See also W71-03148) (Knapp-USGS)
W71-03167

DAMAGE TO IRRIGATION POND DUE TO MINING SUBSIDENCE,
Kyushu Univ., Fukuoka City (Japan). Research Inst. of Science and Industry.
T. Nishida, and K. Goto.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 496-501, 1970. 6 p, 3 fig, 3 tab, 1 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

The irrigation ponds located in the Kyushu coal fields have been damaged due to mining subsidence. The time, point and magnitude of damage, the length of dam, and the geology were compared with the results of the theoretical calculation of the surface strains. The position of the dam within tension zones in both the directions of dam axis and flow axis affects the amount of mining damage to the pond. Increasing the magnitude of tensile strain on the dam by more than 2 mm/m a year causes leakage or exhaustion of pond water. The magnitude of damage to a dam is small in the case where the position of the dam is within the compression zones in both the direction of dam axis and of flow axis, if compressive strain is larger than 3.5 mm/m. A thick clay layer in the pond bottom prevents leakage of pond water. If a fault exists near the surface, there is a greater possibility of a crack appearing than in an undisturbed area. (See also W71-03148) (Knapp-USGS)
W71-03168

ON THE COMPRESSION SUBSIDENCE OF PEAT AND HUMIC LAYERS IN THE KAMI-SHINBASHI AREA, KURATE-MACHI, KURATE-GUN, FUKUOKA PREFECTURE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
T. Noguchi, R. Takahashi, and Y. Tokumitsu.
In: Proceedings of the Tokyo Symposiun on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 458-466, 1970. 9 p, 4 fig, 2 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

In the alluvial plain along the Onga River, Japan, in the Chikuho Coal Field, there are extensive Peat layers which cause serious cases of mining damage as they invite subsidence due to consolidation through dehydration from digging coal. In this district there are distributed widely peat layers of some ten meter thickness and soft clay beds of various thickness. As quite a long time is required for those layers to be consolidated completely, the surface, once restored, subsided again under the load of banked soil, and where the thickness of soft clay changes rapidly, there has occurred irregular subsidence accompanied by inclination of the ground surface. (See also W71-03148) (Knapp-USGS)
W71-03169

SMALL SINKING HOLES IN LIMESTONE AREA WITH SPECIAL REFERENCE TO DRAINAGE OF COAL MINES,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
T. Noguchi, R. Takahashi, and Y. Tokumitsu.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 467-474, 1970. 8 p, 5 fig, 2 tab, 2 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Sinks, *Karst, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Irrigation water.
Identifiers: *Japan.

Sinkholes develop because of mine drainage in the south-eastern end of the Tagawa section of the Chikuho coal field, Japan. The strata in this neighborhood involve the Quaternary, the Tertiary and the Paleozoic. Land subsidence is traced in numerous occurrences of small sinkholes of about 4-10 m in diameter. The site where sinkholes have occurred is composed of limestone which is directly covered with the Quaternary. The Tertiary, which is distributed in the south-eastern part of the area, bears coal seams and was once worked by several collieries. Sinkholes are distributed mainly in the concave part of groundwater surface. Numerous cracks, dolina and caves lie concealed in the surrounding linestone. Sinkholes in the area were caused by the change of water level and velocity of groundwater which is flowing through caves and cracks in limestone. Similar phenomena were confirmed by model experiment. The cause of the change of groundwater can be traced back to the pumping of water at collieries in the south-eastern area, but the change still goes on even after those collieries were closed, owing to pumping from wells drilled for irrigation purposes. (See also W71-03148) (Knapp-USGS)
W71-03170

CONSOLIDATION PHENOMENON CAUSED BY MINE DRAINAGE IN THE AREA OUTLYING FROM WORKING PLACE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
T. Noguchi, R. Takahashi, and Y. Tokumitsu.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 475-482, 1970. 8 p, 6 fig, 1 tab.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Mining, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water quality, Faults (Geology), Fractures (Geology).
Identifiers: *Japan.

In the Kishima collieries, Japan, coal is mined underground and the surface has subsided in places so

detached from the working area that it is impossible to explain by the usual hydrological relations. The Omachi fault (throw 300 m, inclining southward) runs from east to west, and surface subsidence is concentrated along this fault line. The alluvium is composed of clay and gravel beds. Its thickness is 40-50 m on the north of the fault and 350-400 m on the south side. The main cause of subsidence on the north side of the Omachi fault is in the consolidation of the first clay bed, but on the south side the subsidence is in the consolidation of the third clay bed. In this area there are several faults running from north to south, through which the Omachi fault is connected hydraulically with the underground working of the Kishima coal mine. This fact has been proved by the chloride ion test of underground water near and around the Omachi fault. (See also W71-03148) (Knapp-USGS)
W71-03171

MODEL STUDIES OF DIFFERENTIAL COMPACTION,
Georgia Univ., Athens.
Robert E. Carver.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 450-458, 1970. 9 p, 5 fig, 22 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Model studies, Hydraulic models, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology, Faults (Geology), Fractures (Geology).
Identifiers: *Differential compaction.

Phenomena associated with differential compaction of sediments can be reproduced in models employing liquid-solid suspensions subjected to differential vacuum. Suspensions of clay-sized particles which approximate the porosity of young sediments are easily prepared and have viscosities and shear strengths much lower than other, commonly used, fracturable materials. Both field observation and experiment indicate the response to differential compaction is, in many cases, differential subsidence coupled with fracture. Fracture effects vary in scale of displacement from thousands of meters, in regional contemporaneous faults that parallel the coast of Texas, U.S.A. to decimeters in fractures caused by recent withdrawal of groundwater and petroleum in Texas and Arizona. Model studies indicate that a differentially compacting sediment mass fails in shear in a manner analogous to the failure of a simply supported beam. Therefore, fracture of the sediment mass should be predictable, in time and space, if sufficient information about physical properties of the sediment mass is available. (See also W71-03148) (Knapp-USGS)
W71-03172

MODEL EXPERIMENTS ON LAND SUBSIDENCE,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
S. Murayama.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 431-449, 1970. 19 p, 28 fig, 5 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Model studies, *Hydraulic models, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Japan.

In order to investigate the characteristic relations between land subsidence and withdrawal of groundwater in the aquifer, some model experiments on a large scale were performed. Model soil layers were set in a water filled tank. The tanks used were a reinforced concrete tank of a rectangular form of 5 m X 2.7 m, 2.3 m in height, and 2 steel cylindrical tanks, each 2 m in diameter and 1.5 m high. One series of tests was performed on a clay layer placed on a sand aquifer. In the other series of tests, 2 clay layers and 2 sand layers were alternately filled in the steel tank. On the top surface of the soil layers was free surface water. Land movements due to lowering and recovering of the artesian head, land subsidence due to the change in the artesian head, and effects of change in the level of the surface water on the land subsidence and on the artesian head were studied in the models. Under varying artesian head, clay layers and sand aquifer showed subsidence due to compacting. The amount of subsidence caused in the sand layer depends on its initial density and the number of repetitions of the artesian head. (See also W71-03148) (Knapp-USGS)
W71-03173

ANALYSIS OF BOREHOLE EXTENSOMETER DATA FROM CENTRAL CALIFORNIA,
Geological Survey, Sacramento, Calif.
Francis S. Riley.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 423-431, 1970. 9 p, 1 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *California, *Borehole geophysics, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Borehole extensometers.

In subsiding areas of central California, highly sensitive borehole extensometers provide data that define the compression characteristics of the compacting artesian aquifer systems. The extensometer records are combined with hydrographs for the confined and unconfined aquifers to form stress-strain diagrams on which the annual cycles of head decline and recovery generate a series of open loops. Grass compaction, elastic expansion, and net permanent compaction are clearly defined. The average level of preconsolidation stress, the elastic compressibility at lesser stresses, and the much larger plastic compressibility at higher stresses can often be determined from such diagrams. At a given location, these compressibilities may differ by as much as two orders of magnitude. Under favorable circumstances, estimates of the average vertical permeability and average compressibility of the fine-grained strata can be derived. (See also W71-03148) (Knapp-USGS)
W71-03174

THE MECHANICS OF COMPACTION AND REBOUND, WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.
Long Beach Dept. of Oil Properties, Calif.
D. R. Allen, and M. N. Mayuga.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 410-423, 1970. 14 p, 14 fig, 18 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, California, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Oil wells, Injection wells.
Identifiers: *Wilmington Oil Field (Calif).

The ground surface above the center of oil production in the Wilmington Oil Field, California, subsided about 9 meters over 27 years. Subsidence was related to compaction in the oil reservoirs caused by fluid production and pore pressure reduction. Axial loading tests on the reservoir sands and shales show the sands to be as compactable as the shales. Reservoir calculations, oil well casing measurements, and laboratory tests indicated a reduction as great as 3 to 4% in the bulk sand volumes (about 10-11% of the pore volume). It is concluded that most of the compaction prior to 1952 occurred in the reservoir sands. Calculations show 32.4% of the cumulative compaction in the shales and 67.6% in the sands. Water injection programs arrested subsidence and caused elastic rebound, which in conjunction with pump pressures has uplifted the surface as much as 33.5 cm over 8 years. Rebound is believed to be confined principally to the sand intervals. The coefficient of rebound is estimated to be .005 of vertical sand thickness; of which only about 50% is seen at the surface due to unrelieved stresses in the overburden. (See also W71-03148) (Knapp-USGS)
W71-03175

OBSERVATION OF COMPACTION OF FORMATION IN THE LAND SUBSIDENCE OF NIIGATA CITY,
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Shun-ichi Sano.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 401-409, 1970. 9 p, 5 fig, 4 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Radioactivity techniques, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Niigata (Japan).

A method for measuring vertical distribution of compaction of a formation was developed by utilizing radioisotopes. Radiation sources made of cobalt 60 were shot into formations by a gun-perforator in a well at various depths. The sources were measured by a specially designed gamma-ray logger at intervals of about a year. Compaction during the period between two successive measurements was derived from difference of the distances. The two radioisotope observation wells were sunk at Niigata, Japan which has suffered remarkable subsidence since around 1956, and the observation at these wells was carried out since 1961. The observational results could be compared with drainage of groundwater and injection to aquifers. (See also W71-03148) (Knapp-USGS)
W71-03176

FINITE ELEMENT ANALYSIS OF LAND SUBSIDENCE,
Ohio State Univ., Columbus. Dept. of Civil Engineering; and California Univ., Berkeley. Dept. of Civil Engineering.
Ranbir S. Sandhu, and Edward L. Wilson.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 393-400, 1970. 8 p, 4 fig, 20 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Numerical analysis, Computer programs, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Mining, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Finite element analysis.

The finite element method was applied to the problem of land subsidence. The settlement of a land mass is viewed as an immediate or time dependent surface deformation caused by direct application of surface loads or by the loss of support associated with mining or withdrawal of pore fluids. Practically all cases involving static or quasi-static subsidence can be treated. The method permits

consideration of complex geometrical configurations and arbitrary boundary conditions. Nonhomogeneity, anisotropy, viscoelasticity and creep, temperature effects, residual stresses, and plastic behavior can be allowed for. The method is applicable to two or three dimensional deformation and thus takes into account horizontal as well as vertical movements. (See also W71-03148) (Knapp-USGS)
W71-03177

SAND COMPRESSION AS A FACTOR IN OIL FIELD SUBSIDENCE,
San Jose State Coll., Calif. Dept. of Civil Engineering.
James E. Roberts.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 368-376, 1970. 9 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Oil fields, *Sands, Clays, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells.
Identifiers: *Venezuela.

The results of a comprehensive experimental investigation of the compressibility of clastic sediments at high pressures are summarized. In the pressure range of 1,000 to 20,000 psi, some sands are at least as compressible as typical clays. This high compressibility, which is due to a shattering of individual grains, indicates that a stratum of oil-bearing sand which is subjected to effective stress changes may contribute significantly to surface subsidence. The relative importance of clay and sand compression as contributory to subsidence and the conditions under which either or both is important are summarized. It is concluded that even at a depth of 3000 feet compression of oil-bearing sands may contribute significantly to subsidence. (See also W71-03148) (Knapp-USGS)
W71-03178

COMPRESSIBILITIES OF CLAYS AND SOME MEANS OF PREDICTING AND PREVENTING SUBSIDENCE,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
George V. Chilingar, Herman H. Rieke, III, and Costandi Sawabini.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 377-393, 1970. 17 p, 6 fig, 2 tab, 56 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Soil stabilization, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Water chemistry, Electro-osmosis, Clay minerals.
Identifiers: Soil compressibility.

The compressibilities of halloysite, dickite, illite, kaolinite, hectorite, montmorillonite, attapulgite, and soil samples were determined and compared with those determined with the samples saturated with fresh water or sea water. Compressibility ranges from 0.0000 867 to 0.000 294 per psi at 1000 psi and from 0.00000 162 to 0.00000 716 per psi at 100,000 psi. Salinity of the squeezed-out solutions changes with pressure and the mineralization of interstitial waters in shales should be lower than that in associated sandstones, if water moves from shale into sand. Thus, the salinity of interstitial solutions may give a clue as to the degree of subsequent compaction. In addition, decreasing salinity of produced waters with time may indicate water influx into sands from the associated undercompacted shales. A new technique of electrochemical stabilization of undercompacted formations is offered as a possible solution to the subsidence problem. Electrochemical stabilization involves application of direct electric current in conjunction with introducing various electrolytes, such as calcium chloride, aluminum acetate, and aluminum sulfate. (See also W71-03148) (Knapp-USGS)
W71-03179

SOIL-WATER DISEQUILIBRIUM AS A CAUSE OF SUBSIDENCE IN NATURAL SOILS AND EARTH EMBANKMENTS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Soil Mechanics.
O. G. Ingles, and G. D. Aitchison.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 342-353, 1970. 12 p, 5 fig, 32 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, *Tunnels, *Erosion, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Soil mechanics, Rock mechanics, Water wells, Soil erosion.

The widespread occurrence of localized soil subsidences following sub-surface tunnelling by erosion, both in natural soils and in earth embankments, is explained in terms of a metastable state involving chemical, hydrological and mechanical factors. The sources of excessive voids which precondition the soil for such failures and the conditions under which water flow into these voids adversely affect the safety of the soil structure are described. The hazards are most acute when the soil itself is capable of spontaneous dispersion and loss of cohesion in contact with water whose chemical composition is not in equilibrium with the soil. Appropriate procedures for evaluation of the risk of such tunnelling subsidences and available remedial measures are given. (See also W71-03148) (Knapp-USGS)
W71-03180

STUDIES ON PARTIAL COMPACTION OF SOIL LAYER IN REFERENCE TO LAND SUBSIDENCE IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ., Tokyo (Japan).
Shigeru Aoki, and Naomi Miyabe.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 354-360, 1970. 7 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Hydrogeology.
Identifiers: *Tokyo (Japan).

Apparent land subsidence as recorded by compaction recorders is measured in the soil layer between the ground surface and the level where the reference tube of the compaction recorder is fixed. This part of the soil layer is composed of two or more layers which have different mechanical properties. Assuming that the compaction of each soil layer is proportional to the layer's effective thickness, its distance from the groundwater level, and the change in the height of the groundwater level, the compaction recorder response is analyzed into responses caused by the separate layers. (See also W71-03148) (Knapp-USGS)
W71-03181

SHORT-TERM MOVEMENT OF THE LAND SURFACE NEAR WATER WELLS,
Hawaii Univ., Honolulu. Dept. of Geosciences.
Frank L. Peterson, and Stanley N. Davis.
In: Proceedings of the Tokyo Symposium on Land Subsidence, Vol 2, International Association of Scientific Hydrology and UNESCO, September 1969, Tokyo, p 360-367, 1970. 8 p, 5 fig, 11 ref.

Descriptors: *Subsidence, *Withdrawal, *Land subsidence, Aquifers, Water levels, Water table, Water balance, Surface-groundwater relationships, Seepage, Infiltration, Compaction, Damages, Groundwater, Groundwater movement, Pumping, Soil mechanics, Rock mechanics, Water wells, Injection wells, California.
Identifiers: *Santa Clara Valley (Calif).

Stresses related to short-term pumping (or injecting) water from wells result in measurable movements of the land surface. Sensitive transducers coupled to horizontal and vertical extensometers enable relative movements to be measured with a precision of 0.1 micron. The testing periods were limited to about one hour or less owing primarily to strain buildup in the extensometers. Total vertical movement probably ranged between 1 and 100 microns on most of 196 tests on 19 wells, and horizontal movement was as great as 15 microns per meter of lateral distance. With only one exception, short-term effects were almost perfectly elastic. Pumping and injecting equal amounts of water produced movements of similar magnitude but in opposite directions. During pumping, the shape at the surface depression resembled the surface deflection produced by a concentrated load on an elastic plate of infinite extent. (See also W71-03148) (Knapp-USGS)
W71-03182

2G. Water in Soils

SOIL SURFACE CHARACTERISTICS AND RAINFALL-RUNOFF-MOISTURE RELATIONSHIPS ON COASTAL PLAIN SOILS,
Auburn Univ., Ala. Water Resources Research Inst.
Ronald E. Hermanson.
Available from NTIS as PB-196 307, $3.00 in paper copy, $0.95 in microfiche. Auburn University Water Resources Research Institute Bulletin 702, June 1970. 77 p, 21 fig, 5 tab, 74 ref, append. OWRR Project A-005-ALA (1).

Descriptors: *Rainfall-runoff relationships, *Infiltration, *Antecedent precipitation, Soil water movement, Runoff forecasting, Alabama, Soil physical properties, Sands, Clays, Hydraulic conductivity, Vegetation effects, Hydraulic models.
Identifiers: Experimental watersheds.

The hydraulic conductivities of a sandy soil and a sandy clay loam were related to bulk density. Bulk density of the soil was predicted from moisture content and the resistance of the soil as measured by a cone penetrometer. The effects on infiltration of both the soil geometry and the surface cover were determined. An H-flume and Cashocton wheel system for measuring and sampling runoff was modified to minimize sediment deposition in the system. Eight runoff plots were instrumented at a research farm in the Coastal Plain of Alabama. A digital data acquisition system was developed to record runoff, rainfall and other weather data on computer compatible magnetic tape. (Knapp-USGS)
W71-02751

EVALUATION OF EARTHLY MATERIALS FOR USE IN DECONTAMINATION OF WATER,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W71-02752

ENDRIN, DIELDRIN AND ALDRIN ADSORPTION AND DECOMPOSITION BY CLAY MINERALS AND SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02753

SORPTION OF AMIBEN AND THE METHYL ESTER OF AMIBEN BY CLAY MINERALS AND SOILS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02755

GLYCEROL VAPOR ADSORPTION ON CLAY MINERALS AND MONTMORILLONITIC SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02756

MOVEMENT OF SALTS IN PONDED ANISOTROPIC SOILS,
California Univ., Davis. Dept. of Water Science and Engineering.
Jaime Ortiz, and James N. Luthin.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR3, Paper 7530, p 257-264, September 1970. 8 p, 5 fig, 6 ref, append.

Descriptors: *Leaching, *Saline soils, *Saline water-freshwater interfaces, *Tile drainage, Soil water movement, Groundwater movement, Ion transport, Mass transfer, Drainage engineering, Subsurface drainage, Tile drains, Computer programs.
Identifiers: *Ponded anisotropic soils.

A method of determining the displacement front of an interface between saline and fresh water to subsurface drains under ponded conditions is extended to anisotropic soils. A computer program written in FORTRAN IV allows determination of the position of the displacement front at different times when point values of the stream and potential function are available. The results presented can be applied to any other system geometrically similar to the system considered. Leaching in the region halfway between drains will be better for an anisotropic soil than for an isotropic one. (Knapp-USGS)
W71-02757

PROBLEMS OF EVALUATION OF SOIL MOISTURE FOR WATER BALANCES ON LARGE AREAS,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.
Miroslav Kutilek.
In: Symposium on World Water Balance, Vol 1, International Association of Scientific Hydrology Publication No 92, p 129-136, July 1970. 8 p, 1 tab, 5 ref.

Descriptors: *Water balance, *Soil moisture, *Gaging stations, *Network design, Systems analysis, Soil moisture meters, Surveys, Hydrogeology, Water storage, Soil water movement, Hydrologic budget, Data collections, Hydrologic data.
Identifiers: Soil water balance.

The basic criteria for the location of soil moisture observation stations were determined by using systems analysis methods. The stations ought to be located on representative soil districts, considering the dominant types of vegetation, landscape forms and hydrogeological conditions. To extrapolate the measurements beyond the boundary of districts of uniform soil, vegetation, topographic and hydrogeological conditions, functional relationships must be found. A general procedure for the evaluation of the soil moisture data is suggested. In the proposal for soil moisture classification, the following aspects were considered: (1) Quantity of stored water in the profile with regard to the moisture content ranges, (2) duration of these moisture content ranges, (3) moisture stratification. (Knapp-USGS)
W71-02766

THE IMPORTANCE OF RAINFALL AND SOIL MOISTURE IN THE AGRICULTURAL DEVELOPMENT OF THE CLOSED FOREST ZONE OF GHANA,
For primary bibliographic entry see Field 03F.
W71-02794

KHAIRPUR TUBEWELL PROJECT,
West Pakistan Water and Power Development Authority, Lahore.
R. F. Stoner.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 223-246, January 1970. 24 p, 11 fig, 2 tab, 6 ref.

Descriptors: *Water resources, *Water resources development, *Saturated soils, *Subsurface drainage, *Foreign projects, Controlled drainage, Irrigation, Irrigation systems, Runoff, Groundwater, Aquifers, Hydrologic data, Water quality, Salinity, Wells, Water table, Crops, Crop productions, Water quality control.
Identifiers: *West Pakistan, Tubewells.

This water-resources development project covers an irrigable area of 353,000 acres in West Pakistan. The main purpose of the project, as originally defined, was to provide for drainage and reclamation of waterlogged and saline land. As the planning concepts changed with further study the purpose gradually broadened until the main objective of the project became to ensure the best possible use of land and water resources. This objective was to be achieved by lowering the water-table to a level which would not prejudice crop growth; by reducing the soil salinity within the root zone where necessary to promote healthy plant growth; by supplying additional water to raise the cropping intensity from the original level of 90 percent to 135 percent or to even higher intensities if these ultimately prove to be possible and economic. Maps, tables, graphs, and text material are presented in relating plans, methods, and results of the project. Rigid salinity standards were adopted: direct reuse of pumped water was recommended up to a salinity of 1000 ppm; between 1000 and 2,500 ppm groundwater could be used only if mixed with surface water in various proportions; beyond a salinity of 2,500 ppm the groundwater was to be discharged into the drainage system. The design of wells follows the Thiem and Theis equations. An immediate response has occurred to the use of fresh water and subsoil drainage in improved crops and expanded acreage cropped. (Woodard-USGS)
W71-02816

VEGETATION ARCS IN JORDAN,
Hunting Technical Services Ltd., Boreham Wood (England).
L. P. White.
Journal of Ecology, Vol 57, No 2, p 461-464, 1969. 2 fig, 1 tab, 8 ref.

Descriptors: *Sheet flow, *Arid lands, *Hydrogeology, *Vegetation, Xerophytes, Halophytes, Shrubs, Hydrologic aspects, On-site investigations, Mode of action, Environmental effects, Check structures, Leaching, Deserts, Watersheds (Basins), Alluvium, Alkaline soils, Soil chemistry, Plant populations, Saline soils.
Identifiers: *Jordan, *Hummocks, *Vegetation arcs, *Wadis, *Range classification.

Vegetation arcs on otherwise bare alluvial flats were recorded and described from the northern Jordan desert. The valley floor and parts of the basin floor were occupied by saline silted bare flats (Qas). The slopes are low and periodic inundation occurs. The vegetation arcs of the Qas are oriented at right angles to the direction of sheet-flow. Principal components of the arc vegetation are low xerophytic and halophytic shrubs in small groups on wind-blown hummocks. The arcs appear to be a primary colonization and their contiguous hummocks act as check dams to sheet-wash. (Casey-Arizona)
W71-02858

FORAGE POTENTIAL OF IRRIGATED BLUE GRAMA WITH NITROGEN FERTILIZATION,
Southwestern Great Plains Research Center, Bushland, Tex.
O. R. Lehman, J. J. Bond, and H. V. Eck.
Journal of Range Management, Vol 21, No 2, p 71-73, March 1968. 3 tab, 11 ref.

Descriptors: *Grama grasses, *Forage grasses, *Nitrogen, *Water utilization, *Fertilization, Great Plains, Fertilizers, Irrigation effects, Efficiencies, On-site investigations, Range management, Texas, Crop response, Crop production, Proteins, Rates of application, Soil-water-plant relationships, Nutrient requirements.
Identifiers: *Water use efficiency.

Blue grama (Bouteloua gracilis H. B. K.) does not respond to irrigation with increased yields. On irrigated check plots, annual forage production was 1/2-1/4 tons/acre. As N applications were increased from 200-800 lb./acre, blue grama yields and associated protein contents increased. Only the 800 lb./acre treatment resulted in significant yield and protein content increases beyond 1 year. Added N recovery was very low. On the 800 lb. application, recoveries were 53% and 39% in the first and second years, respectively. Water-use efficiencies were greatly increased after N addition. The 800 lb. application increased water use efficiency about 5 times in 2 successive years. Without added N, water use efficiencies were not increased. Apparently, blue grama is a relatively inefficient utilizer on both N and water compared to several other forage grasses. (Casey-Arizona)
W71-02861

SORGHUM FOLIAR RESPONSES TO CHANGES IN SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-02865

INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 05C.
W71-02867

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
R. E. Dennis, K. C. Hamilton, M. A. Massengale, M. H. Schonhorst, and L. J. Erie.
University of Arizona, Cooperative Extension Service and Agricultural Experimental Station, Bulletin A-16, revised July 1966. 40 p, 38 fig, 1 tab.

Descriptors: *Alfalfa, *Forages, *Crop production, *Irrigation, *Arizona, Mites, Water quality, Temperature, Soil-water-plant relationships, Weed control, Nematodes, Fertilization, Arid lands, Moisture availability, Border irrigation, Consumptive use, Flood irrigation, Harvesting, Irrigated land, Insects, Irrigation ditches, Plant diseases, Seeds, Sprinkler irrigation, Preservation, Varieties, Water requirements, Selectivity, Planting management, Hay, Pest control, Fertilizers, Timing, Application methods.
Identifiers: *Crop requirement, *Growing season, Crop adaptation, Corrugation, Inoculation, Irrigation basins, Egyptian alfalfa weevil, Stand establishment.

Alfalfa, the most important forage crop under irrigation in Arizona, is adapted to many climates and soils. It accounts for 20 percent of the total irrigated cropland, and is grown from near sea level elevations at Yuma to over 5,000 feet. About 85 percent of the acreage is located in arid southern

Arizona. Factors accounting for the 4 to 12 tons per acre production include length of growing season, variety, irrigation, management, temperature, water quality and soil fertility. Major sections of this report discuss the alfalfa plant, varieties, seed selections, land selection and preparation, irrigation, fertilization, inoculation (seeding and stand establishment), management, harvesting and preserving methods, weed control, harmful insects and mites, Egyptian alfalfa weevil, alfalfa diseases and nematodes. Alfalfa, because of its rapid growth, length of growing season and large greenery produced, has a high water requirement and needs adequate moisture. Water may be applied by the common border method, corrugations, border ridges, sprinkling and flooding from contour field ditches and of basins. Border width, moisture requirements, irrigation fertilization, and irrigation practices are discussed in terms of crop management. Figures show alfalfa varieties at various stages, diseased species, plant pests, operational harvesting and seeding, consumptive water use, and alfalfa adaption areas. (Popkin-Arizona)
W71-02868

ELECTRICAL EFFECTS AND THE MOVEMENT OF WATER IN SOILS,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
D. Swartzendruber, and S. Gairon.
Available from NTIS as PB-196 314, $3.00 in paper copy, $0.95 in microfiche. Purdue University Water Resources Research Center Technical Report No 13, July 1970. 40 p, 16 fig, 2 tab, 19 ref. OWRR Project B-005-IND (1).

Descriptors: *Soil water movement, *Infiltration, Saturated flow, Electrodes, *Hydraulic gradient, Kaolinite, Clays, Montmorillionite.
Identifiers: Electrical potential, Streaming potential.

The study deals with electrical streaming potential effects on water movement in the soil. For saturated conditions, the only response was the step change in electrical potential at initiation or cessation of hydraulic flow. The direction and magnitude of this 'E step' were consistent with those of the streaming potential phenomenon. The magnitude of the 'E step' was essentially proportional to the hydraulic gradient. For unsaturated flow, electrical potentials measured during upward entry of water into columns of initially air-dry sand kaolinite showed that as the wet front moved past an electrode, characteristic negative peaks were observed. Electrical potential, water flux, and hydraulic gradient were also studied for saturated water flow through plugs of sodium bentonite at concentrations ranging from 11.5 to 35.1% clay. At the lowest clay content, the relationship between electrical potential and hydraulic gradient, and between water flux and hydraulic gradient were both less than proportional, while at 28.4% clay both relationships were strictly proportional and at 35.1% clay the relationship was more than proportional. Even in this latter case, the relationship was linear, displaced from the origin to yield a positive gradient intercept. (Wiersma-Purdue)
W71-02877

A SOIL WATER MODEL FOR TWO CONTRASTING TILLAGE SYSTEMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
V. O. Shanholtz, and J. H. Lillard.
Available at NTIS as PB-196 364, $3.00 in paper copy, $0.95 in microfiche. Virginia Polytechnic Institute and State University, Water Resources Research Center Bulletin 38, October 1970. 217 p, 48 fig, 11 tab, 74 ref, 10 append. OWRR Project A-018-VA (3).

Descriptors: *Evapotranspiration, *Water balance, *Consumptive use, *Corn (Field), *Mathematical models, Computer programs, Simulation analysis, Hydrologic budget, Rainfall, Evaporation, Soil water, Soil moisture.
Identifiers: *Soil water budget.

Techniques were developed to simulate the soil-plant environment as a semi-dynamic hydrologic system. Exponential expressions give reasonable estimates of soil evaporation prior to corn plant emergence. A family of nonlinear curves were used to estimate evapotranspiration after emergence. These curves assumed that pan evaporation was the integrated result of atmospheric demands. Precipitation excess was estimated from an exponential expression using total water storage capacity in the Ap or A soil horizon. Corn plant heights were simulated with a 2-part nondimensional exponential relationship. Rainfall interception was assumed to be a function of rainfall, plant height, and density of cover. Vertical water movement through the soil was assumed to be related to its saturated hydraulic conductivity. All aspects of the model were programmed in the Fortran language for an IBM 360 Computer. A comparison of simulated with observed data indicates very good agreement. With few exceptions, the simulated results were well within sampling variation. (Knapp-USGS)
W71-02883

MOVEMENT OF BACTERIA FROM A RIVER TO A MUNICIPAL WELL--A CASE HISTORY,
Geological Survey, Albany, N.Y.
For primary bibliographic entry see Field 05B.
W71-02909

IRRIGATION: WHEN-HOW MUCH-HOW,
Arizona Univ., Tucson. Cooperative Extension Service.
Allan D. Halderman.
University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-20, Revised April 1970. 16 p, 18 fig, 3 tab, 1 ref.

Descriptors: *Surface irrigation, *Irrigation efficiency, *Water management (Applied), *Irrigation practices, *Soil management, Soil-water-plant relationships, Moisture tension, Moisture deficit, Tensiometers, Soil moisture, Soil moisture meters, Water quality, Root zone, Color, Leaching, Wilting, Growth rates, Border irrigation, Furrow irrigation, Arizona, Arid lands, Moisture availability, Depth, Soil texture, Moisture uptake, Water requirements.
Identifiers: *Irrigator's aid relationship, *Leaching requirement, *Soil-water potential, *Soil tension, Clodding, Leaf temperature, Soil probes, Basin irrigation, Corrugation irrigation.

In this bulletin guides for surface irrigation are discussed. Plant signs indicating when to irrigate include wilting, color, leaf temperature, growth rate, and development stage. Soil signs include available moisture and soil moisture tension. Anticipating moisture needs by planning ahead is emphasized. Water should be applied according to the soil moisture deficiency in the root zone. Leaching requirements for soil and moisture requirements for plants are discussed in terms of water quality and clodding potential. Use of soil probes and tensiometers are described. Water should be distributed evenly by border, furrow, basin and corrugation methods. Mentioned also are soils which absorb water slowly and rapidly. The irrigator's aid relationship is Q time t equals d times A, where Q is stream size in cubic feet per second (cfs), t is time of set in hours, d is depth of water applied in inches, and A is area irrigated in acres. Two examples are worked and conversion factors for miner's inches to cfs to gallons per minute and number of 38-inch rows to width in feet to number of 40-inch rows are given. Figures and tables give ways of establishing when, how much and how to irrigate. (Popkin-Arizona)
W71-02958

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
D. E. Longenecker, E. L. Thaxton, Jr., and P. J. Lyerly.
Texas A and M University, Texas Agricultural Experiment Station, MP-939, December 1969. 12 p, 2 tab, 8 fig, 7 ref.

Descriptors: *Saline water, *Furrow irrigation, *Salinity, Irrigation practices, *Soil water movement, Irrigation water, Soil-water-plant relationships, Leaching, Cotton, Calcium, Magnesium, Water management (Applied), Rainfall, Water chemistry, Texas, Arid lands, Furrows, Salts, Irrigation effects, Saline soils, Slopes, Irrigation systems, Rotations, Planting management, Spatial distribution, Crop response, Seasonal, Subsoil, Rates of application, Frequency.
Identifiers: *Salt concentrations, *Salt movement, *Salinity control, Row spacing, Cations.

This 3-year study of movement, distribution, leaching and accumulation of salt in soils yielded information about a new variable row spacing for cotton. Tests of level irrigation at El Paso and sloping irrigation at Pecos were relocated in order to study cumulative salinity effects of differential irrigation frequencies and rates under current management systems. Soil salinity increases occurred from reduced applications rates of saline water to various row spacings. Salinity increases were due to inadequate leaching. Third-year subsoil salinity was dangerously high. Soluble Ca and Mg concentrations were reversed in soils and waters at both locations. Ca was higher in waters; Mg was higher in soils. Salinity on sloping soils increased with distance from water application sources and was seriously high near lower ends of 1000-foot lengths, regardless of irrigation frequency or rate or the planting system used. Double row bed systems develop high subsoil salinity and require special care to avoid excessive accumulation. On sloping systems where irrigation waters are saline and where rainfall does not leach soil, there is no alternative to heavy water application to maintain low soil salinity. If total water application is less than adequate to control salinity, the leaching process can be intensified by rotation with other systems. Tables and figures showing water analyses, irrigation practices, row spacing salinity and cotton emergence are included in the article. (Popkin-Arizona)
W71-02961

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
A. D. Schneider, and A. C. Mathers.
Texas A and M University, Texas Agricultural Experiment Station, MP-935, October 1969. 7 p, 2 fig, 3 tab, 4 ref.

Descriptors: *Water utilization, *Irrigated land, *Sugar beets, *Texas, *Water management (Applied), Soil-water-plant relationships, Costs, Rainfall, Groundwater, Crop production, Climatic data, Soil moisture, Nuclear moisture meters, Seasonal, Diurnal, Water requirements, Irrigation water, Irrigation efficiency, Plant growth, Application methods, Semiarid climates.
Identifiers: *Irrigated crops, *Texas High Plains, *Growing season.

This article presents results of 1964-1967 sugar beet water use studies under climatic and cultural conditions of the Texas High Plains. Where the season extended from April to October, water use during 2 full growing seasons was 38 to 40 inches. Daily use exceeded 0.25 inch per day for 2 months. Good irrigation water management, which meets crop water requirements and minimizes groundwater use, is necessary. Well pumping capacity determines maximum irrigated sugar beet acreage. Utilization of rainfall and application of irrigated water furnish seasonal water requirements at the least cost. Because growing season rainfall is about 13 inches, it may furnish up to 30 percent of crop water needs. Irrigation efficiency is indicated by numerical examples and tables show climatic data, cultural practices and crop yields. Daily and cumulative water use by sugar beets during the study period is also included. (Popkin-Arizona)

W71-02963

CLIMATE AND SOILS,
Reading Univ. (England). Dept. of Soil Science.
E. W. Russell.
Agroclimatological Methods: Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 193-200, UNESCO, 1968.

Descriptors: *Soil formation, *Geomorphology, *Weathering, *Soil water movement, *Climatology, Permeability, Rainfall, Drainage patterns (Geologic), Solar radiation, Erosion, Residual soils, Vegetation effects, Temperature, Weather, Evapotranspiration, River flow, Soil horizons, Soil profiles, Soil chemical properties, Soil physical properties, Montmorillonite, Mode of action, Rocks, Crystalline rocks, Arid climates, Semiarid climates, Humid climates, Humus, Clays, Hydrolysis, Solubility, Groundwater, Aluminum, Springs, Percolation, Infiltration, Root systems, Water conservation, Land forming, Ion exchange, Watersheds (Basins).
Identifiers: *Pans, *Potential evapotranspiration.

Rock weathering and soil formation involve decomposition in the weathering zone and the fate of the weathering products. The volume of weathering rock remains constant while density decreases. Hydrolysis of parent materials results in solubilization and removal of bases and some silica, while much of the Fe and Al remain behind. These processes vary according to temperature and drainage. In humid climates most of the soluble weathering products drain into rivers and oceans but in arid lands, high river evaporation concentrates solutes, resulting in Ca loss, increase in Na and either Si precipitation or accumulation of high exchange capacity siliceous clays. Under dry soil conditions Fe precipitates as ferric oxide and pans may develop around spring lines. Fe also affects soil permeability to water by tending to coat kaolin particles, creating well-structured permeable clays. Plants act as ionic pumps moving soluble materials from the soil to the surface and producing humus from litter decomposition and root debris. In areas where rainfall is at least equal to potential evapotranspiration, river flow is low but constant. If deep-rooted vegetation is replaced by shallow-rooted vegetation, such as crops, river flow will increase during the dry season when the moisture is needed by plants. Considerations of this kind should influence agricultural procedures. (Casey-Arizona)
W71-02970

AGROCLIMATOLOGICAL STUDIES IN THE LEVANT,
Swedish Meteorological and Hydrological Inst., Stockholm.
For primary bibliographic entry see Field 02B.
W71-02971

LAWN WATERING NEED NOT BE WASTEFUL,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Leonard J. Erie, Orrin F. French, and Lowell True.
University of Arizona, Cooperative Extension Service, Folder 143, November 1968. 11 p, 5 fig.

Descriptors: *Lawns, *Water conservation, *Water management (Applied), *Irrigation practices, *Irrigation effeciency, Soil moisture, Bermudagrass, Arizona, Arid lands, Soil-water-plant relationships, Leaching, Scheduling, Soil types, Consumptive use, Evaporation, Water loss, Saline water, Saline soils, Moisture stress, Water requirements, Rates of application, Water storage, Damages.
Identifiers: *Salt accumulation.

This folder describes techniques of efficient, economical, lawn watering. Water savings of several hundred percent can be achieved by better management of lawn irrigation in Arizona. Over-irrigation and poor scheduling waste water and nitrogen, and create grass yellowing, foundation settlement, street damage and septic tank problems. Soils are compared to a sponge storage reservoir where sandy soils hold only small amounts of water while loam, silt and clay hold more. Research studies on bermudagrass, visual water signals, optimum amount of water per irrigation and quantitative measures of lawn water needs offer solutions to excessive watering. Irrigation should be applied only when plants require water according to weather conditions, soil moisture depletion and visual plant needs. A water-need calculation is given in the brochure. Water should be applied only to replace depleted water and at a maximum depth of 5 inches on dry soil. Occasional deep leaching irrigation will wash out accumulated salts. In Arizona, one bermudagrass irrigation between October and March 15 will be adequate. Appropriate water management saves dollars, fertilizer, water, labor, street repairs and property damage. (Popkin-Arizona)
W71-02976

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
Wallace H. Fuller.
University of Arizona, Agricultural Experiment Station and Cooperative Extension Service, Bulletin A-43, Reprinted July 1967. 21 p, 6 fig, 1 tab, 20 ref.

Descriptors: *Soil management, *Water management (Applied), *Saline water, *Saline soils, *Crops production, Leaching, Salinity, Irrigation water, Water quality, Arid lands, Management, Irrigable land, Soil-water-plant relationships, Soil moisture, Nutrients, Toxicity, Salt balance, Cultivation, Salt tolerance, Irrigation efficiency, Irrigation practices, Arizona, New Mexico, Nevada, California, Salts, Planting management, Timing, Seeds, Rotations, Root systems, Soil water movement.
Identifiers: *Salt control, *Cultural practices, *Permanent agriculture, *Leaching requirement, Semiarid lands, Salt movement.

Arid and semiarid permanent agriculture depend on salt control in soils. Major salt sources are irrigation water and native soil. The manner in which water, soil and crops are managed will determine salt control for economic agricultural production. This bulletin discusses basic principles of water, soil and crop management of irrigated lands to prevent salt accumulation at harmful levels. Management concepts related to long-time irrigation for permanent agriculture are presented. Salt affects plants by reducing moisture, altering nutrient and root conditions, and causing toxicity. Leaching requirement concepts estimate necessary leaching to maintain a favorable salt balance. Water management practices include considerations of timing for irrigation leaching, frequency of irrigation for leaching, water quality and quantity, and salt movement. Soil management practices include tillage to improve water penetration, organic matter and crop residues, and crop-land selection. Cultural management practices include selection of salt-tolerant crops, seed placement and crop rotation. Special management practices permit economic irrigation with saline water in Arizona, New Mexico, Nevada and California. Such irrigation will become more common in order to more economically produce crops. An 18-term appendix, conversion factors and salt tolerance tables are presented. (Popkin-Arizona)
W71-02977

THE PERSISTENCE AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES IN SOILS AND SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02979

WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION FOR APPLICATION TO STUDY OF UNSATURATED FLOW OF SOIL WATER,
Washington State Univ., Pullman. Dept. of Agronomy.
Gordon L. Stewart, and Walter H. Gardner.
Available from NTIS as RLO-1543-5, $3.00 in paper copy, $0.95 in microfiche.n.d. 26 p.
Identifiers: *Soils, Moisture, *Hydrology, Neutron reactions, Thermal neutron cross sections, Nondestructive testing, Nuclear industrial applications, Moisture content, Ground water.

Adequate testing of the applicability of various equations to studies of unsaturated water flow in soil requires a precise method for water content measurement. A neutron-matter interaction technique has been developed in this investigation to measure water contents of small volume elements of soil accurately, rapidly, and at frequent time intervals. This method can be used to measure water content in many types of experiments but it is particularly well suited for experiments involving transient flow. High thermal neutron fluxes, available at the present time only from nuclear reactors, are required. The method is superior to existing methods for measuring, non-destructively, water content as a function of time and position. The inherent precision due to the random nature of neutron production with a neutron count in dry soil of 600,000 c/m, for 2 second counting and a resolution of 1 mm. by 1 cm. for dry and wet water content regions (about 5% and 40% water) are about .. 0.2% and ..0.4% water. For 30 second counting times the precisions improve to about .. 0.05% and 0.1% water. Longer counting times would lead to further improvement. Neutron attenuation is not seriously affected by density changes but soil bulk density can be measured by use of long counting times. Precision for soil bulk density measurement is about .. 0.002 gm./cm. (3) with counting times of about 200 seconds. With improved techniques and fluxes available at a 100 kw reactor it appears possible to improve the present resolution by a factor of 10 beyond that reported.
W71-03084

SOIL HYDRAULIC CONDUCTIVITY MEASUREMENT BY FIELD MONOLITHS,
Ohio Agricultural Research and Development Center, Wooster.
Ehud Stibbe, T. J. Thiel, and G. S. Taylor.
Soil Science Society of America Proceedings, Vol 34, No 6, p 952-954, November-December 1970. 3 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Hydraulic conductivity, *Soil water movement, *Permeameters, *On-site tests, Instrumentation, Analytical techniques, Equipment, Infiltrometers, Lysimeters, Soil moisture meters, Water measurements.
Identifiers: *Soil monoliths (Permeameters).

A method is described for evaluating the saturated hydraulic conductivity (K) of field soils. Vertical water flow in relatively large (over 1.5 sq m) in situ monoliths provides K values that are reproducible and agree well with other techniques for evaluating K. In 1963, two soil monoliths were constructed adjacent to drainage plots on a very poorly drained Toledo silty clay. This soil is a Humic-Gley (Mollic Haplaquept) developed in lacustrine mixed clays and silts, and fractures extensively upon wetting and drying. Perforated plastic pipes (piezometers) were inserted at the lower Ap, the lower B, the upper C horizon interfaces, and at 152 cm. Because only vertical flow occurs in the monoliths, conductivity rates are directly applicable to infiltration, deep seepage, and other situations where vertical flow predominates. Because monoliths require relatively large investments in time and labor, their use may be limited to special situations. Preliminary studies may be made for more costly operations that are dependent on soil flow characteristics. Some examples are drainage installations, aquifer recharge studies, and septic tank leach bed studies. Hydraulic conductivity data can be collected for a

few selected soils in an area. Soil morphological data could then be used to estimate the conductivity of other soils. (Knapp-USGS)
W71-03142

SEPARATION OF ADSORBED CATION SPECIES AS WATER FLOWS THROUGH CLAYS,
Agricultural Research Service, Beltsville, Md., Soil Lab.
For primary bibliographic entry see Field 02K.
W71-03143

THE INFLUENCE OF SOIL WATER MATRIC POTENTIAL ON THE STRENGTH PROPERTIES OF UNSATURATED SOIL,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
John Williams, and C. F. Shaykewich.
Soil Science Society of America Proceedings, Vol 34, No 6, p 835-840, November-December 1970. 6 p, 5 fig, 1 tab, 24 ref.

Descriptors: *Soil strength, *Soil moisture, *Moisture tension, *Effective stress, *Shear stress, Mechanical properties, Soil physical properties, Soil physics, Soil-water-plant relationships.
Identifiers: *Matric potential-soil strength relations.

A study was made of the contribution that matric potential makes to effective stress and therefore the strength properties of two unsaturated soils. The effective stress parameters and the unconfined strength were measured, and the shear strength, effective stress, and a saturation factor were estimated as a function of soil water matric potential over the range-0.59 to -15.1 bars. The strength properties of a Gretna clay increased rapidly with decreasing matric potential. In a Wellwood loam, however, the strength properties remained relatively constant over the range -0.59 to -15.1 bars. A measure of the proportion of the matric potential operative in the effective stress is given by the saturation factor. The influence that matric potential has on the strength of an unsaturated soil is related to the moisture retention properties of the soil. (Knapp-USGS)
W71-03144

INDICES FOR CHARACTERIZING SOIL-WATER REPELLENCY BASED UPON CONTACT ANGLE-SURFACE TENSION RELATIONSHIPS,
California Univ., Riverside. Dept. of Soils and Plant Nutrition.
C. L. Watson, and J. Letey.
Soil Science Society of America Proceedings, Vol 34, No 6, p 841-848, November-December 1970. 8 p, 3 fig, 4 tab, 14 ref.

Descriptors: *Wettability, *Soil physical properties, *Soil chemical properties, *Wetting, Solvents, Surfactants, Moisture tension, Soil water movement, Infiltration, Recharge, Surface tension, Porous media.
Identifiers: *Water-repellent soils.

The relation between apparent liquid-solid contact angle and surface tension was established for three water repellent materials using both a series of aqueous ethanol solutions and organic liquids. The media included two artificially treated sands and one naturally occurring soil. With one exception there was an approximate linear relationship between the cosine of the contact angle and the surface tension. The relationship for the forest soil tended to be curvilinear when using ethanol solutions of high surface tension. A simple drop test using the same materials and ethanol solutions placed the materials in the same order of repellency. The drop test was further developed to allow classification of porous media on the basis of 90 deg surface tension and stability to water interaction. The tests can be readily performed both in the laboratory and the field. Two indices are given to describe water-repellent characteristics of soils. These indices are valuable in assessing erosion and runoff problems, and also the feasibility of surfactants to promote infiltration. (Knapp-USGS)
W71-03145

A MATHEMATICAL SOLUTION TO A HILLSIDE SEEPAGE PROBLEM,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
A. W. Warrick.
Soil Science Society of America Proceedings, Vol 34, No 6, p 849-853, November-December 1970. 5 p, 7 fig, 1 tab, 8 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Slopes, Mathematical studies, Infiltration, Drainage, Subsurface runoff, Topography, Seepage.
Identifiers: *Hillside seepage.

A solution is presented for a two-dimensional hillside seepage problem. The soil is assumed to be water-saturated to the soil surface where the soil water is at atmospheric pressure. Seepage occurs into the flow medium along the upper part and out along the lower part of the sloping soil surface. The flow medium is infinitely deep and bounded laterally by vertical streamlines. Conformal transformations are used to find the hydraulic head and stream functions. Although the solution is analytic, a complex integral must be evaluated numerically for application. Numerical data presented includes flownets, seepage velocities, infiltration angles, and volume of flow as a function of slope. (Knapp-USGS)
W71-03146

2H. Lakes

TOWARD THE FAUNA OF OSTRACODA IN RYBINSK RESERVOIR,
L. A. Luferova.
Available from NTIS as PB-189 285T, $3.00 in paper copy, $0.95 in microfiche. BIOLOGIYA I TROFICHESKIE SVYAZI PRESNOVODNYKH BESPOZVONOCHNYKH I RYB. SBORNIK STATE I. AKADEMIYA NAUK SSSR, INSTITUT BIOLOGII VNUTRENNIKH VOD, TRUDY, NO. 17 (20) 'NAUKA', LENINGRAD, 1968, p 76-81. Russian transl. by Narragusett Marine Game Fish Research lab., July 1969. 9 p, 4 fig, 7 ref.
Identifiers: *Crustacea, *Ecology, Distribution, Population, Classification, Periodic variations, Marine biology, Lakes, USSR, *Ostracoda.

The majority of ostracods are poor swimmers. They live on the botton, in the pelogen, and on the surface of plants. However, at slight depths not exceeding lm, their entry into the water mass with the dense turbidity of the bottom in the littoral zone is quite possible. In the majority of cases ostracods yield in abundance to copepods and cladocerans, although in some cases (early spring, isolated days in July and August, at the start of winter) there were more of them than cladocerans, and in April and December they surpassed the other crustaceans in number. For clarification of the species composition of ostracods, the seasonal dynamics of their abundance, and the primary sites of habitation, 4 fixed stations were set up in the littoral zone of the reservoir near Borka. Material was collected once every 10 days from the end of May through November at these stations.
W71-02842

NUTRITIVE RATIONS AND FOOD COEFFICIENTS OF PREDATORY FISHES IN RYBINSK RESERVOIR,
M. N. Ivanova.
Available from NTIS as PB-189 891T, $3.00 in paper copy, $0.95 in microfiche. BIOLOGIYA I TROFICHESKIE SVYAZI PRESNOVODNYKH BESPOZVONOCHNYKH I RYB. SBORNIK STATE. AKADEMIYA NAUK SSSR, INSTITUT BIOLOGII VNUTRENNIKH VOD, TRUDY, NO. 17 (20), 'NAUKA', LENINGRAD, 1968, p 180-198. Russian Translation by Narragauset Marine Game Fish Research Lab., June 1969. 27 p.
Identifiers: *Fishes, Food, *Lakes, Fishes, Aging (Physiology), Population, Ecology, Nutrition, Ingestion (Physiology), Periodic variations, Weight, Food chains.

The rations and food coefficients of different species of predators change rather substantially in relation to age. The magnitude of annual rations varies in relation to foraging conditions in a particular year. The fattening conditions of juvenile pike, pikeperch, burbot and perch in the reservoir are relatively constant. The amount of food eaten by adult predators (3-7 years) in years which have different foraging conditions (abundant water and scant water) is subject to great variations. Their annual rations can change rather substantially; for example, in the pikeperch from 0.7 to 2.0. in the pike from 3.4 to 5.7 etc. Food coefficients in all predators increase considerably with age. The largest coefficient is in the burbot - a psychrophilic species which feeds primarily during winter. The feeding spectrum is narrower in the burbot than in the other predators in Rybinsk Reservoir. The lowest food coefficient and consequently also the amount of food eaten per unit of growth, occurs in the pikeperch. The factors which determine the size of the food coefficient are the degree of mobility of the fish and the rate of its weight increase. Therefore in predators which are not very mobile and lead a demersal way of life, the food coefficient is less than in mobile inhabitants of the water thickness.
W71-02843

SOME CHARACTERISTICS OF THE OPERATIONAL RESERVOIRS IN THE ISRAEL NATIONAL WATER SYSTEM,
H. Leventer.
Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Verhandlungen, Vol 17, p 1017-1030, November 1969. 3 tab, 10 fig, 16 ref.

Descriptors: *Impounded waters, *Reservoir operation, *Water supply, *Water quality, *Limnology, Consumptive use, Arid lands, Organic matter, Plant growth, Nutrients, Dissolved oxygen, Stratification, Phytoplankton, Nitrogen compounds, Diatoms, Reservoirs, Water chemistry, Chemical properties, Phosphates, Decomposing organic matter, Sediments, Algae, Reservoir stages, Potable water, Water level fluctuations, Benthos.
Identifiers: *Impoundment effects, *Israel National Water System, *Bottom settling, *Submerged plant growth, Tsalmon Reservoir (Israel), Netofa Reservoir (Israel), Zohar Reservoir (Israel), Microstratification, Turnover.

Tsalmon, Netofa and Zohar are the most important reservoirs of the Israel National Water System, which supplies ground and surface waters for drinking and agricultural purposes. These 3 reservoirs are described in terms of impoundment influence on water quality. Zohar, in the south, was filled in 1960. Tsalmon and Netofa, in the north, were filled in 1964. Three stages of youthful reservoir regime are noted: (a) bottom settling of organic matter (January to April); (b) intensified decomposition of organic matter (April to June); and (c) abundant growth of submerged plants (July to November). Zohar Reservoir functions by the 'floating on the system' method, where high nutrient concentration permits dissolved oxygen (D.O.) stratification on phytoplankton growth. Frequent water level fluctuations decrease the algae quantity and break stratification. Because the northern reservoirs function in series, phytoplankton do not develop but settle to the bottom. Source water chemical composition and reservoir water properties (temperature, Secchi disc, D.O., stratification, P and N compounds, phytoplankton, limnological and bottom conditions) are discussed. Also mentioned are turnover, diatom abundance, microstratification, and plankton assemblages. Tables show chemical composition of source water and reservoir sediment and reservoir P and N concentrations. Figures show dominant reservoir

plankton and distribution, reservoir and source chemistry, and reservoir location. (Popkin-Arizona)
W71-02871

CHEMICAL, PHYSICAL AND BIOLOGICAL DYNAMICS OF NORTHERN PRAIRIE LAKES,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 05C.
W71-02880

THE REPRODUCTIVE CYCLE OF DAPHNIA IN AN ARCTIC POOL,
Arctic Inst. of North America, Washington, D.C.
R. G. Stross, and D. A. Kangas.
Available from NTIS as AD-711 214, $3.00 in paper copy, $0.95 in microfiche. Ecology, Vol 50, No 3, p 457-460, Late Spring 1969. 2 fig, 15 ref. ONR-307 105.
Identifiers: *Arthropods, Reproduction, Physiology, *Reproduction (Physiology, *Arctic regions, Life cycle, Temperature, Metabolism, Insects, Entomology, *Daphnia.

The reproductive cycle of Daphnia middendor ffiana living in an arctic pool and an arctic lake is essentially the same. An overwintering generation produces one brood of young before shifting to produce broods of embryos which enter diapause. The pool warms more rapidly than the lake and has twice the number of day degrees above 0C. The higher temperature acts only to accelerate the development rate of the Daphina, and the reproductive shift occurs in mid-July rather than in late August. The restriction of population growth to one brood of young in the warmer pool and colder lake is used to illustrate the hypothesis that artic temperature influences reproductivity by controlling life cycle rather than by restricting rates of metabolism.
W71-02956

EXTRACTION AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES FROM LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02978

STUDIES ON THE INTERACTIONS OF AQUATIC BACTERIA AND AQUATIC NEMATODES,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W71-03013

THE EFFECTS OF COPPER SULFATE ON CERTAIN ALGAE AND ZOOPLANKTERS IN WINNISQUAM LAKE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 05F.
W71-03014

BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03021

A TWO-YEAR STUDY OF BACTERIAL POPULATIONS IN INDIANA FARM POND WATERS,
Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
For primary bibliographic entry see Field 05G.
W71-03023

ACETYLENE REDUCTION ASSAY FOR DETERMINATION OF PHOSPHORUS AVAILABILITY IN WISCONSIN LAKES,
Wisconsin Univ., Madison. Dept. of Biochemistry.
For primary bibliographic entry see Field 07B.
W71-03024

NUTRIENTS AND QUALITY IN IMPOUNDED WATER,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 05C.
W71-03028

AUTOECOLOGICAL AND SAPROBIOLOGICAL INVESTIGATIONS OF FRESH WATER CILIATES (IN GERMAN),
Bonn Univ. (Germany). Zoological Inst.
For primary bibliographic entry see Field 05G.
W71-03031

THE SEASONAL SUCCESSION AND DISTRIBUTION OF PLANKTONIC DIATOMS IN UNIVERSITY LAKE IN RELATION TO SILICON CONCENTRATIONS,
North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
John A. Soyak.
MS Thesis in Public Health, Univ of North Carolina, Dep of Environmental Sciences and Engineering, 1970. 31 p, 30 fig, 13 tab, 47 ref. OWRR Project B-003-NC (2) and B-007-NC (1).

Descriptors: *Seasonal, *Succession, *Distribution, *Plankton, *Diatoms, North Carolina, Epilimnion, Depth, Silica, Thermocline, Isotherms, Dissolved oxygen, Light penetration, Temperature, Turbidity, Hydrogen ion concentration, Spectrophotometry, Agricultural watersheds, Geologic formations, Chemical reactions, Absorption.
Identifiers: *Silicon cycle, University Lake (NC), Synedra ulna, Synedra delicatissima, Synedra rumpens, Bottom stratum, Biological uptake.

An investigation of University Lake (North Carolina) was made to determine seasonal succession and distribution of planktonic diatom populations, taking into consideration concentration of silicon and various chemical, physical, and biological parameters affecting their distribution. Spectrophotometry was utilized for determination of silicon. Frustules of dead diatoms and suspended material in the epilimnion settle out of the water mass according to Stokes law. While held in suspension, re-solution of the silicon took place creating an inverse clinograde depth distribution. Evidence indicates that a complicated succession of diatom maxima and minima occurred throughout the year. Individual diatom numbers were greatest during the summer but the silicon level in the epilimnion increased steadily throughout this period. Thus, it was not large diatom populations or 'blooms' which were associated with reduction in silicon but rather individual species. The greatest biological uptake of silicon occurred during April-May when the diatom diversity was largest. Three diatom species, Synedra ulna, Synedra delicatissima, and Synedra rumpens were associated with this spring decrease in silicon concentration within the epilimnion. An inverse clinograde depth distribution of silicon was observed during the summer with the highest concentration in the bottom water stratum. (Jones-Wisconsin)
W71-03037

A COMPARATIVE PRE- AND POST-IMPOUNDMENT SURVEY OF THE HELMINTH AND CRUSTACEAN PARASITES OF MICROPTERUS SALMOIDES (LACEPEDE) AND M PUNCTULATUS (RAFINESQUE) (PERCIFORMES) IN BEAVER RESERVOIR, ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
Mitchell D. Norman.
MS Thesis, Dep of Zoology, University of Arkansas, Fayetteville, 1970. 96 p, 4 fig, 4 tab, 68 ref. OWRR Project A-009-ARK (4).

Descriptors: *Reservoirs, *Surveys, *Parasitism, Crustaceans, Arkansas, Infection, Watersheds (Basins), Bass, Trematodes, Nematodes, Snails, Plankton, Copepods, Fish, Worms.
Identifiers: *Helminth, *Micropterus salmoides, *Micropterus punctulatus, Beaver Reservoir (Ark), Urocleidus furcatus, Urocleidus principalis, Actinocleidus fusiformis, Clavunculus bursatus, Cestodes, Hirundinea, Acanthocephala, Posthodiplostemum minimum, Metacercariae, Neoechinorhynchus clindratum.

A comparative pre- and post-impoundment survey of helminth and crustacean parasites of Micropterus salmoides and M punctulatus was made. Monogenetic trematode incidence increased following impoundment. Percent infection of Urocleidus furcatus and U principalis decreased in 1967 in Micropterus punctulatus. In 1967 Actinocleidus fusiformis decreased in M punctulatus. The 1964 survey showed U furcatus and U principalis did not follow monogenetic trematode pattern. Clavunculus bursatus inclined to decrease following impoundment until 1967; monogenetic trematode incidence decreased in upper reservoir in 1967. Parasites developing with a change of hosts decreased immediately following impoundment. In a post-impoundment survey, Posthodiplostemum minimum did not show fluctuations in per cent infection the first two impoundment years, attributable to viability of metacercariae within the hosts. Tremendous increase in incidence of P minimum and Neoechinorhynchus cylindratum in 1966 suggests their intermediate hosts adjusted to the new environment within two years. P ambloplitis larvae showed higher infection incidence in lower reservoir in 1964. With impoundment of that reservoir portion, parasites utilizing plankton forms would probably decrease. Adult stage of P ambloplitis increased in upper reservoir in 1966. Incidence of Ergasilus caeruleus followed that of parasites with direct life cycles, apparently stabilizing in 1966. (Jones-Wisconsin)
W71-03040

ON RECONCILING LAKE CLASSIFICATION WITH THE EVOLUTION OF FOUR OLIGOTROPHIC LAKES IN OREGON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Douglas W. Larson.
Ph D Thesis, Dep of Fisheries and Wildlife, Oregon State University, Corvallis, 1970. 145 p, 29 fig, 14 tab, 155 ref. A-003-ORE (1).

Descriptors: *Oligotrophy, *Lakes, *Oregon, *Classification, Phytoplankton, Primary productivity, Carbon radioisotopes, Bioassay, Chlorophyll, Watershed (Basins), Elevation, Optical properties, Thermal properties, Water chemistry, Biomass, Geology, Eutrophication, Climates, Temperature, Dissolved oxygen, Zooplankton, Chlorophyta, Cyanophyta, Chrysophyta, Daphnia, Fish, Shrimp, Mayflies, Benthos, Photosynthesis, Phosphorus, Dissolved solids, Soils, Recreation, Energy, Limnology.
Identifiers: *Lake evolution, Crater Lake (Ore), Odell Lake (Ore), Waldo Lake (Ore), Woahink Lake (Ore), Morphometry.

Data were collected from four oligotrophic Oregon lakes--Crater, Odell, Waldo, and Woahink. Phytoplankton primary production was estimated periodically using a standard carbon-14 in situ method. Bioassays were conducted to determine whether water samples, treated with various kinds and concentrations of inorganic nutrients, might stimulate phytoplankton carbon uptake. Chlorophyll a measurements complemented production estimates. Comparing the lakes, differences in origin, watershed features, basin morphometry, surface elevation, optical and thermal properties, and water chemistry were noted; more significant were differences in phytoplankton

primary production and biomass. During July and August 1969, productivity averaged 253.1 (Crater), 1533.2 (Odell), 35.5 (Waldo), and 301.1 (Woahink) mg carbon/sq m per day; concentrations of chlorophyll a averaged 34.4 (Crater), 99.03 (Odell), 4.7 (Waldo), and 24.7 (Woahink) mg/sq m, resulting from the different usages the lakes receive. Judging by productivity, lakes seem to be unique environments evolving at different rates in response to natural and artificial (culture use) enrichment. A classification system, based on relationship between phytoplankton primary productivity and light energy absorbed by phytoplankton for photosynthesis is proposed to diagnose, to a degree, causes of eutrophication to provide instantaneous productivity assessment. (Jones-Wisconsin)
W71-03042

ENERGY FLOWS IN THE PELAGIC ECOSYSTEM OF THE LAKE DALNOE (KAMCHATKA) (IN RUSSIAN),
E. M. Krokhin.
Doklady Akademii nauk SSSR, Vol 189, No 5, p 1118-1121, 1969. 1 fig, 1 tab, 6 ref.

Descriptors: *Energy transfer, *Productivity, *Lakes, Trophic level, Primary productivity, Fish, Zooplankton, Phytoplankton, Nutrients.
Identifiers: Lake Dalnoe (USSR), Pelagic ecosystem.

The flow of energy in an ecosystem is synonymous with the transfer of food from one to another trophic level. In Lake Dalnoe (Kamchatka, USSR), the production in the higher trophic level is about 1/10th of that of the food source level. Thus, the annual production in potassium cal/sq m or in percent of the primary production is given by the following sequence: Phytoplankton - 2435 (100%), zooplankton - 282 (11.6%), planktophagous fish - 37 (1.5%), predatory fish - 2.6 (0.1%). (Wilde-Wisconsin)
W71-03044

MOVEMENT OF PHOSPHATE AND OTHER IONS FROM AND THROUGH LAKE MUDS,
Waterloo Univ. (Ontario). Dept. of Biology.
H. B. N. Hynes, and B. J. Greib.
Journal Fisheries Research Board of Canada, Vol 27, No 4, p 653-668, 1970. 4 fig, 1 tab, 23 ref.

Descriptors: *Mud-water interfaces, *Lakes, *Eutrophication, *Water quality control, Phosphorus, Ions, Iron, Ammonia, Oxygen, Tracers, Sands.
Identifiers: *Eutrophication control, *Polyethylene coverings, Paradise Lake (Canada), Abiotic movement.

Covering of undisturbed or disturbed lake muds with sheets of polyethylene or a layer of sand reduced the loss of oxygen in the overlying water and greatly decreased the release of phosphate, iron, and ammonium from the sediment. Injections of ammonium and phosphates, including phosphorus-32 labeled fertilizer, 4 cm below the mud-water interface disclosed that both nitrogen and phosphorus move readily upwards into water from either rich calcareous muds or peat-like acid muds. A suggestion is offered that covering bottoms of valued lakes with polyethylene may counteract the process of eutrophication. (Wilde-Wisconsin)
W71-03045

ESTIMATES OF SESTON CROPS BY FILTRATION WITH GLASS FIBER DISCS,
Colorado Dept. of Game, Fish and Parks, Glenwood Springs; and Colorado State Univ., Fort Collins. Dept. of Zoology.
Dale F. Reed, and Edward B. Reed.
Journal Fisheries Research Board of Canada, Vol 27, No 1, p 180-185, 1970. 3 fig, 4 tab, 7 ref.

Descriptors: *Analytical techniques, *Seston, *Filtration, *Gravimetric analysis, Reservoirs, Colorado, Diatoms, Chlorophyta, Zooplankton, Cyanophyta, Pigments, Nannoplankton, Oligotrophy, Lakes, Phytoplankton, Detritus.
Identifiers: *Glass fiber discs, Dixon Reservoir (Colo), Optical density, Dry weight.

The primary objective of this study was to compare the effectiveness of glass fiber filters with centrifugation in removing seston from natural lake water containing mixed populations of phyto- and zooplankters as well as organic and inorganic detritus. The comparison was made by concentrating seston from a small fluctuating reservoir. Fifteen sets of samples drawn over a 2-month period showed that the filters removed about twice as much seston, by dry weight, as did the centrifuge. In view of current interest in the extraction of pigments from seston, a secondary objective was to compare optical densities of extracts from seston obtained by filtration with those obtained by centrifugation. Complete solution of pigments, as indicated by greenish or more frequently, bluish-green color remaining on wet filters after extraction, was not achieved. Filtration is quicker and requires less sample water than centrifugation. (Jones-Wisconsin)
W71-03051

EFFECTS OF CONTROLLED NUTRIENT DILUTION ON THE EUTROPHICATION OF A LAKE,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-03057

EFFECT OF RECENT ACIDIFICATION OF WATER ON THE PLANKTON ORGANISMS IN LAKE TOYA, HOKKAIDO (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Plankton Lab.
For primary bibliographic entry see Field 05C.
W71-03102

2I. Water in Plants

A SHORT STUDY ON CONSUMPTIVE USE AND THE DATA REQUIRED IN IRAN,
Iran Plan Organization, Tehran. Water Planning Group.
For primary bibliographic entry see Field 03F.
W71-02803

MICRO-CLIMATE EVALUATION OF HEATING IRRIGATION WATER ON COTTON AND THE RESULTING EFFECT ON COTTON YIELD AND QUALITY,
High Plains Research Foundation, Plainview, Tex.
James Valliant, and T. C. Longnecker.
Symposium on Thermal Agriculture, Sixth, January 22-23, 1969, Atlanta, Georgia, Proceedings, p 40-41, 1969. 5 tab.

Descriptors: *Irrigation practices, *Cotton, *Thermal water, *Temperature, Crops, Irrigation effects, Texas, Rainfall, Productivity, Soil temperature, Agronomic crops, Field crops, On-site investigations, Environmental effects, Water temperature, Crop production, Crop response, Microenvironment, Heated water, Air temperature.
Identifiers: *Thermal agriculture.

Cotton crops were irrigated over 3 years with heated water of 65-85 degree F. temperature ranges in an effort to determine the effects on crop yield. Irrigation treatment included: (1) preplant irrigation only, (2) preplant plus 2 irrigations and (3) preplant plus 2 irrigations with heated water. Heated and unheated water both reduced soil temperature 1-6 degrees F. below air temperature. Heated water had no consistent effect earlier flowering, the number of bolls or earlier cotton production. (Casey-Arizona)
W71-02859

FORAGE POTENTIAL OF IRRIGATED BLUE GRAMA WITH NITROGEN FERTILIZATION,
Southwestern Great Plains Research Center, Bushland, Tex.
For primary bibliographic entry see Field 02G.
W71-02861

APPARENT SAP VELOCITIES IN BIG SAGEBRUSH AS RELATED TO NEARBY ENVIRONMENT,
Renewable Resources Center, Reno, Nev.
Gerald F. Gifford.
Journal of Range Management, Vol 21, No 4, p 266-268, July 1968. 5 fig, 1 tab, 5 ref.

Descriptors: *Arid lands, *Sagebrush, *Transpiration, *Physiological ecology, *Microenvironment, Xerophytes, Nevada, Temperature, Wind velocity, Solar radiation, Humidity, Regression analysis, On-site investigations, Velocity, Soil moisture, Soil-water-plant relationships, Shrubs, Heat transfer, Niches, Environmental effects, Ecosystems, Habitats, Plant physiology, Great Basin, Water loss.
Identifiers: *Sap velocity, Relative humidity, *Heat pulse technique.

The major factor in xerophyte ecology is plant-water relations. The big sagebrush (Artemesia tridentata Nutt.) is probably the most abundant and widespread xerophyte in the U.S., but the factors influencing its transpiration have been little studied. A sagebrush community in alluvially derived soils with no profile development was studied in western Nevada. Sap stream velocities were measured by the heat pulse method and correlated with 15 measured environmental variables. A 30-variable multiple regression equation accounted for only 54.05% of sap velocity variability. While sap flow velocities cannot be directly correlated with yearly transpirational volume, it would appear that physiological control is a major determinant of transpirational water losses. (Casey-Arizona)
W71-02863

SORGHUM FOLIAR RESPONSES TO CHANGES IN SOIL WATER CONTENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W71-02865

STRUCTURE AND FUNCTION OF THE KIDNEY AND THE WATER BALANCE OF DESERT BATS,
San Diego State Coll., Calif. Dept. of Zoology.
Roger E. Carpenter.
Physiological Zoology, Vol 42, No 3, p 288-302, July 1969. 5 fig, 3 tab, 37 ref. NSF Grant GB-4570.

Descriptors: *Water loss, *Water balance, *Animal behavior, *Physiological ecology, *Xerophilic animals, Arid lands, Laboratory tests, Animal metabolism, Aestivation, Heat resistance, Water conservation, Heat budget, Environmental effects, Mammals, Digestion, Mode of action, Moisture stress, Respiration, Diets, Food habits, Ureas, Chlorides, Migration, Evaporation, Habitats, Selectivity.
Identifiers: *Animal thermoregulation, *Bats, *Renal concentration mechanisms, *Renal structure, *Torpor.

Bats are probably the most successful arid zone mammals, suggesting the possibility of unique physiological water conservation mechanisms. Two arid zone insectivorous species, Tadarida brasiliensis and Eptesicus fuscus and one occasional arid zone nectar-feeding species, Leptonycteris sanborni, were studied and compared in terms of thermoregulation, excretory and evaporative water loss and kidney structure. The insectivorous species thermoregulated during daytime torpor with reduced evaporative water losses while Leptonycteris was always homeothermic with small water loss variations. Water losses therefore reflected general behavioral and thermoregulatory patterns. E. fuscus maintained body weight on protein diets

as high as 23.2% while some T. brasiliensis tolerated 28.3%. The insectivorous bats also tolerated much higher dietary salt levels and this was reflected in extremely thick renal medullary tissue which is a general phenomenon in desert-inhabiting, urine-concentrating mammals. The water conservation mechanisms of these animals is discussed in terms of their ecology and it is concluded that: (1) although they have high urine-concentration capacities, the primary water conservation of the insectivorous species is the behavioral adaptation of flying long distances to free water and (2) the nectar diet of L. sanborni obviates the necessity of renal concentration and allows an independence of free water. (Casey-Arizona)
W71-02866

INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 05C.
W71-02867

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02G.
W71-02868

BARLEY--DATES AND RATES OF PLANTING,
Arizona Agricultural Experiment Station, Tucson.
A. D. Day, and R. K. Thompson.
Progressive Agriculture in Arizona, Vol 22, No 4, p 6-7, 16, July-August 1970. 2 tab.

Descriptors: *Planting management, *Barley, *Rates, *Timing, *Plant growth, Arizona, Soil-water-plant relationships, Lodging, Arid lands, Consumptive use, Crop production, Optimization, Irrigation practices, Seeds, Moisture availability, Grains (Crops), Irrigation practices, Irrigation efficiency.
Identifiers: *Planting rates, *Planting dates, *Crop yield potential, Maximum tillering, Mesa Experiment Station (Arizona).

Dates and rates of planting are important because of their effects on growth and development of all agricultural plants. Optimum date and rate of seeding crops is knowledge essential for maximum production of high quality plant products. Arizona barley is planted in November or December and harvested in May or June of the following year. This study was undertaken to determine optimum date and rates of planting barley grown under irrigation in Arizona. Harlan and Arivat barley plots were studied at the Mesa Experiment Station, Arizona. Early planting saves water, as one irrigation is eliminated, and saves seeding rate, since vegetative period in which to tiller and develop roots is longer. Optimum dates and rates will differ with varieties. Minimum rates of planting are suited to November and December planting dates because temperatures and winter moisture are conducive to prolonged vegetative period and maximum tillering. Present barley planting rates could be decreased without decreasing grain yields. Arizona growers should plant high quality seed at lower rates to increase yield potential and grain quality by reducing lodging. Tables show average grain yields, volume rates, and numbers of heads and seeds for barley plots from 1961 to 1965. (Popkin-Arizona)
W71-02872

MERCURY CONTENT OF PLANTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02893

IRRIGATION: WHEN-HOW MUCH-HOW,
Arizona Univ., Tucson. Cooperative Extension Service.
For primary bibliographic entry see Field 02G.
W71-02958

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

GRAIN SORGHUM ROW SPACING AND PLANTING RATES UNDER LIMITED IRRIGATION IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plain Research Center.
For primary bibliographic entry see Field 03F.
W71-02962

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W71-02963

THE INFLUENCE OF XYLEM ARRANGEMENT AND TRANSPIRATION ON THE DISTRIBUTION OF SOLUTES IN COTTON,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
For primary bibliographic entry see Field 02D.
W71-02968

LAWN WATERING NEED NOT BE WASTEFUL,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W71-02976

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W71-02977

PHYSIOLOGICAL AND BIOCHEMICAL CONTRIBUTIONS TO THE TAXONOMY OF THE GENUS CHLORELLA. IV. UTILIZATION OF ORGANIC NITROGEN COMPOUNDS (IN GERMAN),
Erlangen-Nuremberg Univ. (West Germany). Botanisches Institut.
Erich Kessler, and Franz-Christian Czygan.
English summary. Archiv fur Mikrobiologie, Vol 70, p 211-216, 1970. 1 tab, 16 ref.

Descriptors: *Chlorella, *Plant morphology, *Nitrogen, Amino acids, Classification, Nutrients.
Identifiers: *Chlorella kessleri, Nicotinamide, Chlorella luteovirdis, Organic nitrogen, Glutamic acid, Glutamine, Nicotinic acid, Purine.

A total of 71 autotrophic strains of Chlorella, belonging to 8 species, were investigated as to their ability to utilize different forms of nitrogen. Glutamic acid provided a satisfactory diet for 63 and glutamine for 67 strains; nicotinic acid was used by 1, nicotinamide by 9, and purine by 16 strains. The 7 strains of Chlorella kessleri on a diet of nicotinamide exhibited strikingly better growth than that of morphologically similar Chlorella luteoviridis and other species. However, utilization of the 5 investigated nitrogen sources cannot serve as a taxonomic criterion for this genus of algae. (Wilde-Wisconsin)
W71-03032

CRYPTOGAMIC PLANTS OF THE U.S.S.R. VOLUME VII, SILICOFLAGELLATOPHYCEAE,
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
Z. I. Glezer.
Transl. of Flora Sporovykh Rastenii SSSR; VII, Kremnevie Zhgutikovye Vodorosli, Moscow 1966. Available from NTIS as TT-70-50046, $3.00 in paper copy, $0.95 in microfiche. Israel Program for Scientific Translations, Jerusalem, 1970. 363 p.
Identifiers: *Aquatic plants, USSR, *Algae, Morphology, Ecology, Translations, Reproduction, Physiology, Taxonomy, Distribution, Evolution, *Cryptogamic plants, *Silicoflagellata.

History of studies of silicoflagellates; general characteristics of silicoflagellates; introduction to the systematics of silicoflagellates; distribution of ancient silicoflagellates on the territory of the USSR; evolution of silicoflagellate flora; phylogeny of silicoflagellates; and systematics of the class Silicoflagellatophyeae Borgert.
W71-03198

2J. Erosion and Sedimentation

SLUMP FEATURES ON THE MISSISSIPPI FAN, NORTHEASTERN GULF OF MEXICO,
Naval Oceanographic Office, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-02760

THE BRAIDED STREAM DEPOSITIONAL ENVIRONMENT: COMPARISON OF THE PLATTE RIVER WITH SOME SILURIAN CLASTIC ROCKS, NORTH-CENTRAL APPALACHIANS,
Illinois Univ., Chicago. Dept. of Geological Sciences.
Norman D. Smith.
Geological Society of America Bulletin, Vol 81, No 10, p 2993-3013, October 1970. 21 p, 24 fig, 3 tab, 49 ref, append.

Descriptors: *Sedimentary structures, *Bed load, *Sediment transport, *Alluvial channels, Colorado, Nebraska, Gravels, Sands, Sand waves, Dunes, Braiding, Meanders, Rivers, Channel morphology, Deposition (Sediments).
Identifiers: *South Platte River, *Platte River, *Braided streams.

Studies of the South Platte and Platte Rivers in Colorado and Nebraska show that braided patterns in streams are created mainly by accretion of longitudinal bars and dissection of transverse bars. Coarse, poorly sorted sediment favors formation of longitudinal bars, and finer grained, better sorted materials form transverse bars. The relative proportion of transverse to longitudinal bars increases downstream with the load increase of sediment of finer sizes downstream. This is accompanied by an increase in the ratio of planar cross-stratification to horizontal stratification and a decrease in cross-channel topographic relief expressed as a bed-relief index. (Knapp-USGS)
W71-02762

SEDIMENTATION ENGINEERING, CHAPTER IV. SEDIMENT SOURCES AND SEDIMENT YIELDS.
American Society of Civil Engineers, New York.

Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY6, p 1283-1329, June 1970. 47 p, 26 fig, 10 tab, 93 ref, append.

Descriptors: *Sedimentation, Sedimentation rates, Strip mines, Runoff, *Sediment production, *Sediment yield, Sediment transport, Storms, Gully erosion, Channel erosion, Rainfall, *Erosion, Bibliographies, Analytical techniques, Accelerated erosion, Disposition (Sediments), Sheet erosion, Equations, Sediment concentration.
Identifiers: Engineering works.

Methods and procedures for determining erosion rates from waterborne sediments and sediment yield or deposition rates at locations downstream from the erosion source are analyzed. Emphasis is placed on the erosion types and processes that cause the most engineering problems by large sediment quantities or by locally severe damages incurred. Accelerated erosion and deposition rates from the activities of man are of special concern; these derive from sheet erosion processes on tilled lands and from specialized activities such as strip mining, urban development, construction of highways and utilities, and sheet erosion on any portion of the land surface that is denuded or inadequately protected. Erosion and deposition rates caused by channelization or runoff waters in upland gullies and downstream drainageways are also considered. Present bases for estimating the rates on a storm and an average annual basis are given. Has 93 references. (USBR)
W71-02855

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
Gilbert L. Jordan, and Michael L. Maynard.
Progressive Agriculture in Arizona, Vol 22, No 4, p 10-13, July-August 1970. 6 photos.

Descriptors: *Watershed management, *History, *Soil conservation, *Soil erosion, *Revegetation, Sediment transport, Stream erosion, Channeling, Gulley erosion, Sediment control, Reservoir silting, Floodwater, Bank erosion, Sedimentation rates, Dam construction, Rangegrasses, Arizona, Arid lands, Semiarid climates, Brush control, Alluvium, Arroyos, Phreatophytes, Erosion control.
Identifiers: *San Simon Watershed (Arizona).

San Simon Valley, in southeastern Arizona, extends from the Arizona--New Mexico border northwest to Solomon, Arizona, where the San Simon River enters the Gila. This 65-mile long, 25-mile-wide valley covers about one million acres of semi-arid rangelands and watersheds. It varies in elevation from 3000 to 4000 feet. The average annual rainfall is 9.5 inches. This historic valley is a frail watershed, subject to excessive soil erosion and channel development. Shrub control, revegetation and dam construction are practiced to develop the depleted watershed. Preliminary attempts to revegetate the area failed, and sedimentation behind dams is a serious problem. Sediment behind one dam advanced 8 miles upstream from 1953 to 1967. In 1962 the Bureau of Land Management, Safford District, and the Department of Watershed Management, University of Arizona, contracted to research the valley's soil and water problems. Successful seedings have since been accomplished. There are photographs of topography, gulleying, floodwater damage and sediment problems. (Popkin-Arizona)
W71-02874

MORPHOLOGY AND STRUCTURE OF WILMINGTON AND BALTIMORE SUBMARINE CANYONS, EASTERN UNITED STATES,
University Coll. of Swansea (Wales). Dept. of Geology.
Gilbert Kelling, and Daniel J. Stanley.
Journal of Geology, Vol 78, No 6, p 637-660, November 1970. 24 p, 13 fig, 3 tab, 31 ref.

Descriptors: *Valleys, *Sediment transport, *Erosion, *Channel morphology, Drowned (Submerged), Underwater, Coasts, Canyons, Channels, Geomorphology, Sedimentation.
Identifiers: *Submarine canyons, Wilmington canyon, Baltimore canyon.

An investigation of the detailed morphology of Wilmington and Baltimore submarine canyons reveals that their salient features and inferred history are very similar. Both canyons trend predominantly southeastward, but the heads display a north-trending hook termination on the shelf. Abrupt alterations in the axial trend of each canyon occur at roughly equivalent axial distances and are accompanied by sharp changes in axial gradient and in the geometry of the canyon profile. The shorter length, lower axial gradient, and less acute profiles of Baltimore canyon indicate that it is morphologically more mature than Wilmington canyon. Continuous seismic reflection profiles in this region have penetrated more than 1 km of sediment, Tertiary and Quaternary in age, but including reflector zones of probable Upper Cretaceous age near the base. Buried channels occur below the shelf adjacent to the heads of Wilmington and Baltimore canyons and indicate that southeast-trending portions of both canyons were initiated by drainage emanating from the vicinity of Delaware Bay during a late Tertiary lowstand. Originating during the Tertiary epoch as a topographic depression on the upper rise, Baltimore valley has acquired its present form through several cycles of erosion and deposition but is at present inactive. Wilmington valley displays a similar complex history, but the presence of a narrow, active channel within the valley suggests that this feature is currently funneling sediment downslope from the shelf and across the upper rise. (Knapp-USGS)
W71-02911

CLIMATE AND SOILS,
Reading Univ. (England). Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W71-02970

EXTRACTION AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES FROM LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02978

RUNOFF AND EROSION CONTROL BY SEEDED AND NATIVE VEGETATION ON A FOREST BURN: BLACK HILLS, SOUTH DAKOTA,
Forest Service, Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04A.
W71-03131

WIND EROSION EQUATION: COMPUTER SOLUTION AND APPLICATION,
Agricultural Research Service, Manhattan, Kans. Div. of Soil Erosion; and Kansas State Univ., Manhattan. Dept. of Statistics and Computer Science.
E. L. Skidmore, P. S. Fisher, and N. P. Woodruff.
Soil Science Society of America Proceedings, Vol 34, No 6, p 931-935, November-December 1970. 5 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Soil erosion, *Wind erosion, *Computer programs, *Erosion control, Winds, Slopes, Vegetation effects, Climates.
Identifiers: *Wind erosion control.

A wind-erosion equation was programmed for computer solution. The relationships among variables are evaluated by the computer, and the general functional relationship between soil loss and independent variables is solved stepwise to give potential average annual soil loss in tons per acre per annum for specified conditions of erodibility, roughness, climatic factor, equivalent field length, and equivalent vegetative cover. The computer also can solve the equation to determine field conditions necessary to reduce potential erosion to a tolerable amount and can compare the effectiveness of various combinations of erosion-control treatments. (Knapp-USGS)
W71-03140

PARTICLE SIZE SORTING OF PROGLACIAL EOLIAN MATERIALS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
D. P. Franzmeier.
Soil Science Society of America Proceedings, Vol 34, No 6, p 920-924, November-December 1970. 5 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Sediment transport, *Suspended load, *Saltation, *Loess, *Dunes, Silts, Sands, Winds, Particle size, Aeolian soils, Glacial drift, Sedimentation, Erosion, Deposition (Sediments).
Identifiers: *Particle size sorting (Winds), *Outwash.

Bagnold proposed that there is a critical size separating particles moved by saltation from those carried in suspension. This theory was tested in proglacial deposits near the Wabash and White Rivers in Indiana. Here the westerly winds of glacial times piled the sand by saltation into a band of dunes and carried the silt in suspension and deposited it as loess east of the dunes. Soil C horizons were sampled in transects across the dune and loess belts of both areas and were analyzed for particle size using narrow size intervals. In both areas a zone between 40 microns and 80 microns diameter separates dune sand from loess. Between these limits the dune sands and loess are more than 94% exclusive of each other. Glacial till that is representative of the source of outwash, which, in turn, is the source of the oelian deposits, contains much 40 to 80 micron material. This size fraction, however, is practically missing from both the dunes and the loess. Apparently this fraction was selectively removed by wind or by water and deposited elsewhere. (Knapp-USGS)
W71-03147

2K. Chemical Processes

EVALUATION OF EARTHLY MATERIALS FOR USE IN DECONTAMINATION OF WATER,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W71-02752

EXCHANGE OF DIQUAT CATIONS IN SOIL CLAYS, VERMICULITE AND MONTMORILLONITE WITH HOAI INTERLAYERS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
For primary bibliographic entry see Field 05B.
W71-02754

WATER RESOURCES DATA FOR TEXAS, 1968 - PART 2. WATER QUALITY RECORDS.
Geological Survey, Austin, Tex. Water Resources Div.

Available from District Chief, Water Resources Div, US Geol Survey, Federal Office Bldg, 300 E 8th St, Austin, Tex. 78701. Geological Survey Basic Data Duplicated Report, 1970. 746 p, 3 tab, 17 ref, index.

Descriptors: *Water resources, *Water quality, *Surface waters, *Texas, Chemical analysis, Sediment transport, Sediment load, Water temperature, Rivers, Streams, Streamflow, Flow rates, Chemical analysis, Data collections, Hydrologic data, Sampling.
Identifiers: *Basic data report.

Water quality analyses of samples collected throughout the state of Texas during the 1968 water year (October 1967-September 1968) are tabulated. Samples usually were collected at or near points on streams where gaging stations are maintained by the U. S. Geological Survey for measurement of water discharge. Discharge records for streams in Texas have been released in the report 'Water Resources Data for Texas, 1968, part 1. Surface Water Records.' Most of these records are used in conjunction with the computations of the chemical constituents and sediment loads. Samples were collected daily at 109 stations and periodically at numerous other sites. Miscellaneous sam-

les were collected to evaluate water quality at lo-ations where water-development projects are like-y to be built, and to delineate water-problem areas. At the 10 chemical-quality stations in the Rio Grande basin where samples were collected by the nternational Boundary Commission and analyzed y the U. S. Department of Agriculture, samples ere collected daily at two stations and from 1 to l samples were collected each month at eight sta-ons. Water temperatures were measured at most f the water-quality stations. At stations where ermographs are located, the records consist of aximum and minimum temperatures for each day nd the monthly averages. Headings for chemical uality tables include sampling location; drainage rea; records available; extreme values for dis-olved solids, hardness, specific conductance, and ater temperatures; and remarks. (Woodard-SGS)
W71-02759

EOCHEMICAL BALANCE OF A SMALL VATERSHED AND ITS GEOMORPHIC IMPLI-ATIONS,
Maryland Geological Survey, Baltimore; Van-erbilt Univ., Nashville, Tenn. Dept. of Geology; nd Johns Hopkins Univ., Baltimore, Md. Dept. of arth and Planetary Sciences.
mery T. Cleaves, Andrew E. Godfrey, and Owen . Bricker.
Geological Society of America Bulletin, Vol 81, No 0, p 3015-3032, October 1970. 18 p, 7 fig, 9 tab, 7 ref. ACS Grant 665-G2 and NSF Grant GP 660.

Descriptors: *Geochemistry, *Weathering, *Small vatersheds, *Leaching, *Maryland, Erosion, Geomorphology, Prescipitation (Atmospheric), Vegetation effects, Climates, Weather, Solubility, Water chemistry.
Identifiers: *Chemical weathering.

A detailed input-output study of a small forested vatershed draining the Wissahickon Formation in he Piedmont of Maryland revealed that chemical olution is five times as effective in removing naterial as is mechanical erosion. Solution veathering removes 16.9 tons/sq mi/yr of material ompared with 3.2 tons/sq mi/yr by mechanical rosion. Plant activity during the growing season ncreased the concentration of silica, bicarbonate, alcium, and potassium, thus increasing total dis-olved solids by one-third. The concentrations of ulfate, potassium, and calcium increases whereas ilica and bicarbonate decrease in concentration luring a flood cycle. During the first half of a flood ycle, both the flood water and the dissolved solids n it come from an area in and immediately ad-acent to the flood plain. Approximately one-half of he erosion of the Pond Branch watershed is caused y chemical solution of the silicate minerals aolinite, vermiculite, biotite, and oligoclase. (K-napp-USGS)
W71-02761

DISTINGUISHING WINTER FROM SUMMER RECHARGE TO GROUNDWATER IN SOUTHERN ARIZONA BY DEUTERIUM ANAL-YSIS,
Arizona Univ., Tucson; and Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02F.
W71-02769

A PRACTICAL GUIDE TO WATER QUALITY STUDIES OF STREAMS,
Federal Water Quality Administration, Cincinnati, Ohio. National Field Investigations Center.
For primary bibliographic entry see Field 02A.
W71-02885

CHEMICAL BEHAVIOR OF MERCURY IN AQUEOUS MEDIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02889

MERCURY CONTENTS OF NATURAL THERMAL AND MINERAL FLUIDS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02890

SOURCES AND BEHAVIOR OF MERCURY IN SURFACE WATERS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02891

BIOLOGICAL FACTORS IN THE CHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02892

TRITIUM FALLOUT IN THE PACIFIC UNITED STATES,
California Univ., Los Angeles. Dept. of Chemistry.
J. S. Leventhal, and W. F. Libby.
Journal of Geophysical Research, Vol 75, No 36, p 7628-7633, December 20, 1970. 6 p, 2 fig, 9 tab, 12 ref. AFOSR-AF-1255-67.

Descriptors: *Fallout, *Tritium, *Distribution patterns, *United States, Data collections, Meteorological data, Sampling.
Identifiers: *Tritium fallout.

Tritium has been measured since the 1961-1962 nuclear tests to determine fallout patterns. Crater Lake tritium data are used for a model of mixing and fallout. Ocean-atmosphere-continent effects of stratosphere fallout and dilution by ocean water show continental and latitudinal variation. The samples showed both continental and latitudinal effects. As the collection of samples progressed farther inland from the coast, the diluting ocean effect was less important and reevaporation of continental water was more important as reflected in higher tritium concentrations. This increase was also observed at higher latitudes, nearer the latitude of nuclear tests, and also of the lower less stable tropopause. Several ocean samples collected near river outlets showed very large (as much as 20 times) increases of tritium due to rain and runoff as compared with open ocean values. (Knapp-USGS)
W71-02898

A CARBONATE CHEMISTRY PROFILE AT THE 1969 GEOSECS INTERCALIBRATION STATION IN THE EASTERN PACIFIC OCEAN,
Rochester Univ., N.Y. Dept. of Geological Sciences.
Taro Takahashi, R. F. Weiss, Charles H. Culberson, John M. Edmond, and Douglas E. Hammond.
Journal of Geophysical Research, Vol 75, No 36, p 7648-7666, December 20, 1970. 19 p, 4 fig, 7 tab, 22 ref.

Descriptors: *Water chemistry, *Pacific Ocean, *Carbonates, Hydrogen ion concentration, Carbon dioxide, Salinity, Water temperature, Alkalinity, Calibrations, Analytical techniques, Gas chromatography, Electrochemistry.
Identifiers: *Carbonate chemistry.

To compare and evaluate measurements made by the various laboratories participating in the Geochemical Ocean Section Study (Geosecs), four carbonate chemistry parameters, pH, pCO_2, alkalinity, and total dissolved CO_2, as well as temperature and salinity were measured for samples collected at the Geosecs intercalibration station. The alkalinity values measured by the pH method agree with the values measured by the potentiometric acid titration method within 1%, and the total CO_2 values measured by the chromatographic method agree with the values measured by the potentiometric acid titration method within 2%. The observed 3 to 5% difference between the total CO_2 values measured by the Chromatographic and infrared methods is attributed to the biological alteration of the unpoisoned samples used for the infrared methods. When two of the four measured carbonate parameters were used to calculate the remaining two parameters, the calculated values are found to differ systematically from the measured values for those two parameters. Such a discrepancy can be eliminated if a 30% error in the second apparent dissociation constant for carbonic acid is assumed. (Knapp-USGS)
W71-02899

TRITIUM PROFILE AT THE NORTH PACIFIC (1969) GEOSECS INTERCALIBRATION STATION,
Wolfgang Roether, Karl-Otto Munnich, and H. Gote Ostlund.
Journal of Geophysical Research, Vol 75, No 36, p 7672-7675, December 20, 1970. 4 p, 1 fig, 1 tab, 5 ref. Grant GA-1336 NSF.

Descriptors: *Mixing, *Sea water, *Tracers, *Tritium, Fallout, Currents (Water), Distribution patterns, Data collections, Sampling, Water analysis, Diffusion, Turbulence.
Identifiers: Tritium profiles (Pacific Ocean).

A detailed tritium concentration profile at the Geosecs (1969) station in the North Pacific has been measured. From 0 to 150 meters, values are relatively constant at about 23 TU and then decrease rapidly to 0.2 TU at 400 meters and greater depths. The tritium data show that there is a steplike decrease in vertical mixing intensity at a depth of approximately 150 meters. Detailed tritium measurements are of great value in evaluating the vertical mixing properties of the ocean on a time scale of several years. The vertical mixing found in the region between depths of 150 and several hundreds of meters is considerably smaller than many earlier estimates based on other methods. It seems reasonable, however, in light of other experimental and theoretical results. (Knapp-USGS)
W71-02900

TRACE ELEMENT CALIBRATIONS AND PROFILES AT THE GEOSECS TEST STATION IN THE NORTHEAST PACIFIC OCEAN,
Woods Hole Oceanographic Inst., Mass.
Derek W. Spencer, D. E. Robertson, K. K. Turekian, and T. R. Folsom.
Journal of Geophysical Research, Vol 75, No 36, p 7688-7696, December 20, 1970. 9 p, 9 fig, 6 tab, 9 ref.

Descriptors: *Trace elements, *Sea water, *Pacific Ocean, Data collections, Sampling, Surveys, Calibrations, Chemical analysis, Water analysis, Analytical techniques, Profiles.
Identifiers: Sea water analysis.

Four laboratories collaborated on the trace element analysis of sea water samples obtained on the 1969 Geosecs test cruise in the northeast Pacific Ocean. The elements determined were Sr, Cs, Rb, Co, Ni, Sc, Cu, Sb, Zn, Fe, and U. Two or more laboratories reported on Sr, Cs, Zn, Fe, and U. The general agreement was good. Depth variations were noted for some elements. Acidified samples were higher in Fe, Zn, and Co than the unacidified samples. Except for surface iron values, filtering had no effect on concentration. (Knapp-USGS)
W71-02901

IRON REMOVAL USING MAGNESIUM OXIDE,
Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W71-02904

METHODS OF ANALYZING OILFIELD WATERS: CESIUM AND RUBIDIUM,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
A. Gene Collins.
Bureau of Mines Report of Investigations 6641, 1965. 18 p, 2 fig, 5 tab, 43 ref.

Descriptors: *Geochemistry, *Chemical analysis, *Water analysis, *Cesium, *Trace elements, Oil fields, Flame photometry, Spectrophotometry, Brines, Solvent extractions, Solvents, Water pollution sources, Tracking techniques.
Identifiers: *Rubidium.

Knowledge of the cesium and rubidium content of oilfield waters aids in resolving the origin of waters and petroleum, exploring for petroleum and other valuable minerals, discovering water pollution sources, and augmenting the knowledge of geologic formations. Methods are described to permit the detection of less than 0.01 mg/liter of cesium and/or rubidium in a complex oilfield brine or water. Solvents possessing high-dielectric constants were evaluated for their ability to extract cesium and rubidium tetraphenylboron from oilfield waters and for their flame emission characteristics. Nitroethane was selected and used for the extraction and flame spectrophotometric determinations because it gave the highest sensitivity. Cesium 137 and rubidium 86 were used to determine the extraction efficiencies, which were about 87 percent and 58 percent respectively using a single 10 ml nitroethane extraction from a distilled water matrix. The standard deviation of the determination was 0.0008 mg for cesium and 0.0007 mg for rubidium in the 0.01 mg range. (Knapp-USGS)
W71-02949

TRANSPORT OF SALTS AND WATER ACROSS A CATION EXCHANGER UNDER A GRADIENT OF HYDROSTATIC PRESSURE,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 03A.
W71-02951

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

THE UPTAKE OF ZINC BY CHLORELLA (IN GERMAN),
S. Matzku, and E. Broda.
English summary. Planta (Berl), Vol 92, No 1, p 29-40, 1970. 5 fig, 1 tab, 23 ref.

Descriptors: *Chlorella, *Adsorption, *Zinc radioisotopes, Light, Aeration, Calcium.
Identifiers: *Chlorella fusca, Saturation kinetics, Michaelis constant.

Under optimum conditions of light and aeration, labeled zinc is effectively taken up by Chlorella fusca during long periods and the element cannot be completely washed out from tissues. The velocity of uptake depends on the zinc content of the cells, concentration of calcium in the solution, and follows saturation kinetics. The uptake does not influence the efflux of preabsorbed rubidium. Part of the labelled zinc can be slowly removed from tissues with a carrier solution of zinc chloride and calcium chloride, or with EDTA. (Wilde-Wisconsin)
W71-03039

UTILIZATION OF BIOGENIC ELEMENTS BY A PHYTOPLANKTON COMMUNITY DEPENDING ON THEIR CONCENTRATION IN THE AQUATIC ENVIRONMENT AND ILLUMINATION CONDITIONS (IN RUSSIAN),
Moscow State Univ. (USSR).
V. D. Fedorov, T. I. Belaya, and V. N. Maksimov.
English summary. Izvestiya Akademii nauk SSSR, Vol 3, p 398-414, 1970. 4 fig, 5 tab, 12 ref.

Descriptors: *Phytoplankton, *Productivity, *Nutrition, Photosynthesis, Phosphorus, Iron, Light, Nitrates, Chemicals.
Identifiers: Nutrient concentration, Sodium nitrate, Monosodium phosphate, Iron sulfate.

Planned addition of sodium nitrate, monosodium phosphate, and iron sulfate permitted to establish a relationship between the consumption of nutrients and production of phytoplankton at different illumination intensities. Analysis of obtained regression equations indicated that the consumption of biogenic elements per unit of the biomass increases with a higher concentration of nutrients. An increase in the concentration of phosphorus, however, lowered the uptake of nitrogen; a reversed trend was not observed. An increase in the concentration of phosphorus and iron augmented the consumption of both elements. 100% increase in the intensity of light lowered the consumption of all introduced nutrients. (Wilde-Wisconsin)
W71-03053

SIMPLE INSTRUMENTATION FOR MEASURING TEMPERATURE GRADIENTS AT THE SEA-AIR INTERFACE, INCLUDING THE RESULTS OF WINTER 1964/65 MEASUREMENTS,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 07B.
W71-03081

NITRATE AND AMMONIUM CONTENTS OF WISCONSIN LIMESTONES,
Wisconsin Univ., Madison. Dept. of Soil Science.
P. M. Chalk, and D. R. Keeney.
Nature, Vol 229, No 5279, p 42, January 1, 1971. 1 p, 1 tab, 5 ref.

Descriptors: *Nitrates, *Ammonium salts, *Limestones, *Wisconsin, *Water pollution sources, Groundwater, Laboratory tests, Methodology, Aquifers.

Nitrate-nitrogen was determined in 210 limestone samples from quarries throughout Wisconsin. Major geological formations sampled were Niagara (Silurian), Galena Black River (Ordovician), Lower Magnesian (Ordovician), and Mendota (Cambrian) dolomites. Determinations were made with the nitrate-selective ion electrode. Nitrate-nitrogen and ammonium-nitrogen also were determined in seventy-four of these samples using the direct steam-distillation method. Close agreement was found between nitrate-nitrogen values determined by the two procedures. All samples contained measurable amounts of these forms of nitrogen, and values as high as 37 ppm (parts per million) nitrate-nitrogen and 18 ppm ammonium-nitrogen were obtained. There seemed to be no relationship between nitrate content and type of limestone. Results indicated that many limestones are a potential source of nitrate to percolate waters and that geological contributions of nitrate should be considered when evaluating sources of nitrate to groundwaters. (Woodard-USGS)
W71-03111

PREPARING POLYWATER AND OTHER ANOMALOUS LIQUIDS,
Worcester Polytechnic Inst., Mass. Dept. of Chemistry.
P. A. Christian, and L. H. Berka.
Chemistry, Vol 44, No 1, p 25-28, January 1971. 4 p, 4 fig, 15 ref.

Descriptors: *Water properties, *Water chemistry, *Water structure, *Water types, *Water of crystallization, Water analysis, Water vapor, Condensation, Methodology, Laboratory tests, Gels.
Identifiers: *Polywater, *Anomalous liquids, Pyrex capillaries, Quartz capillaries.

Several methods for preparing columns of anomalous water in microscopic pyrex of quartz capillaries are reviewed. Basically, these methods involve the condensation of water vapor in freshly drawn microscopic (10-100 micron) capillaries under controlled conditions. Depending upon the relative humidity of the atmosphere to which the capillaries are exposed, these methods may be classified as either saturated or unsaturated. In the saturate method, which is the simpler technique, capillarie are exposed to an atmosphere containing wate vapor at saturation pressure for periods rangin from several hours to several weeks. In the unsatu rated technique, there are two ways of exposin capillaries to water vapor slightly below the satura tion pressure. The first is very similar to the satu rated method, except that a concentrated salt solu tion is substituted for distilled water. The vapo pressure of water in the salt solution is considerabl lower than that of distilled water; thus, the relativ humidity inside the vessel is only 80-95% instead o 98-100%. Some of the polywater samples have two-phase structure and appear to consist of a clea and a Vaseline-like, gelatinous phase, wherea most of the other polywater samples appear to hav small granular particles dispersed throughout th column. (Woodard-USGS)
W71-03112

EVIDENCE THAT POLYWATER IS A COL LOIDAL SILICATE SOL,
Naval Research Lab., Washington, D.C.
For primary bibliographic entry see Field 01B.
W71-03113

DETERMINATION OF MERCURY IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W71-03114

CARBON DIOXIDE IN THE SURFACE WATER OF THE ICE-COVERED BERING SEA,
Alaska Univ., College. Inst. of Marine Science.
J. J. Kelley, Jr., and D. W. Hood.
Nature, Vol 229, No 5279, p 37-39, January 1 1971. 3 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Water chemistry, *Carbon dioxide *Surface waters, *Oceans, *Data collections, *Sea ice, Sea water, On-site investigations, Ships, At mosphere, Sampling, Analysis, Hydrologic data.
Identifiers: *Bering Sea, *U.S. Coast Guard ic breaker (Northwind).

The distribution of CO2 between the atmosphere and the sea over open leads and polynyi in the ice covered Bering Sea was measured from the U. S Coast Guard ice breaker Northwind during Februa ry 1970. Measurements were made with an infrared analyzer, MSA LIRA 200. The concentration (mixing ratio) of CO2 are reported in parts per mil lion by volume dry air. The equilibrium concentra tion of CO2 in the sea water restricted by leads and polynyi in an ice covered sea showed that the wate was supersaturated in CO2 with respect to air and the magnitude of the supersaturation was relatively constant over a wide area of the sea ice pack of the south-eastern Bering Sea. The average concentra tion difference between CO2 in the sea and air dur ing the cruise was closely comparable with that ob served in this particular region of the Bering Sea during the summer when ice free condition prevailed. (Woodard-USGS)
W71-03115

THE DETERMINATION OF SHORT-CHAIN FATTY ACIDS IN AQUEOUS SOLUTION BY GAS-LIQUID CHROMATOGRAPHY,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05A.
W71-03118

AUTOMATED ANALYSIS OF AMMONIA IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05A.
W71-03119

EPARATION OF ADSORBED CATION SPE-
IES AS WATER FLOWS THROUGH CLAYS,
gricultural Research Service, Beltsville, Md., Soil
ab.
. D. Kemper, I. D. Sills, and L. A. G. Aylmore.
oil Science Society of America Proceedings, Vol
, No 6, p 946-948, November-December 1970. 3
2 fig, 1 tab, 3 ref.

escriptors: *Ion exchange, *Reverse osmosis,
Clay minerals, Clays, Ion transport, Membrane
ocesses, Ions, Mineralogy.
entifiers: *Ion separation.

heory predicts that adsorbed divalent cations
ove upstream and monovalent cations move
ownstream in a mixed ion system, when solutions
low concentration are forced through clay. Data
om small size mica support this prediction. (K-
pp-USGS)
71-03143

L. Estuaries

LUMP FEATURES ON THE MISSISSIPPI FAN,
ORTHEASTERN GULF OF MEXICO,
aval Oceanographic Office, Washington, D.C.
R. Walker, and J. V. Massingill.
eological Society of America Bulletin, Vol 81, No
, p 3101-3108, October 1970. 8 p, 10 fig, 2 ref.

escriptors: *Deltas, *Mississippi River, *Deposi-
on (Sediments), Sedimentary structures,
eomorphology, Mud flows, Sedimentation, Sedi-
ents, Mud, Silts, Sands, Continental slope,
arine geology.
entifiers: *Slumps, *Mississippi Delta, *Missis-
pi Fan.

uring recent geologic time, the Mississippi River
stem has been the dominant contributor of ter-
genous sediment to the northeastern Gulf Basin.
large mass of sediments has been produced on
e continental slope seaward of the mouth of this
stem. This sedimentary feature is the Mississippi
n. Several crossings of the fan yield seismic
cords that led to the conclusion that large scale
mps were active on the fan in very recent time.
ne slump movement originated near the mouth of
e Mississippi Trough and moved about 160 nm
ward the southeast. A part of this slump flowed to
e south and southwest, or a second slump
eveloped at about the same time and flowed in
is direction for a distance of about 130 nm. The
utheasterly slump is about 70nm in width, and
e smaller slump, to the west, is nearly 38 nm
ide. The maximum measured vertical distance
om the point of origin of these features to the
wnslope limit is about 4000 ft. (Knapp-USGS)
71-02760

ESIDENCE TIMES OF WATERS BEHIND
ARRIER ISLANDS,
orida Univ., Gainesville. Water Resources
esearch Center.
Y. Chiw, J. Van de Kreeke, and R. G. Dean.
vailable from NTIS as PB-196 628, $3.00 in
per copy, $0.95 in microfiche. Completion Re-
rt, Florida Water Resources Research Center,
ainesville, Publication No 11, August 1970. 100
17 fig, 31 ref, 4 append. OWRR Project A-007-
LA (2).

escriptors: *Estuaries, Mixing, Flushing, *Disper-
on, Numerical models, Florida, Lagoons, *Inlets
Waterways), *Tidal waters, Tides, Flow,
ischarge (Water), *Convection, Circulation.
dentifiers: Lake Worth (Fla), Sarasota (Fla), Bar-
er islands, *Residence time (Water), Mass trans-
rt, Water exchange, Net flow, Convective trans-
rt.

stuaries separated from the ocean by barrier
lands are numerous on the Atlantic and Gulf of
lexico coastlines in general and on the Florida
oastline in particular. Attention is focused on the exchange processes of waters behind barrier islands. Part I deals with the non-dispersive aspects as affected by tides and freshwater discharges. A computational procedure is developed with reference to Lake Worth and Sarasota Bay, Florida. The tide-induced net flow, through one or two inlets which can be viewed as a 'mass-transport' effect, is stressed. This net flow can be significant in water exchange considerations and could be enhanced by the proper design of inlets. Field and/or model corroboration of this conclusion is recommended. Part II of the report considers the renewal of estuary waters resulting from dispersive transport in tide-driven flows. Assuming quasi-steady state conditions, dispersion coefficients are presented, based on field measurements in Lake Worth and Sarasota Bay. The measurements are also interpreted in terms of residence times for the northern and southern portions of Lake Worth, Florida.
W71-03007

BACTERIA IN ESTUARINE (BRAS d'OR LAKE) SEDIMENT,
Dalhousie Univ., Halifax (Nova Scotia). Inst. of Oceanography.
E. H. Anthony.
Canadian Journal of Microbiology, Vol 16, No 5, p 373-389, 1970. 6 fig, 7 tab, 20 ref.

Descriptors: *Bacteria, *Estuaries, *Sediments, Salinity, Sampling, Numerical analysis, Population, Filters.
Identifiers: Bras d'Or Lake (Canada), Chromogens, Fresh counts, Frozen counts.

Bacteria numbers in sediments of an estuarine environment (salinity 20-25%) in Cape Breton Island, Nova Scotia, was determined by membrane filter counts from 73 fresh and 67 frozen samples from 20 stations and results compared. Taylor's model (log variance — a .. b log mean) was used to determine dispersion on filters and normalizing transformations in preference to aligning data with Poisson expectation via Fisher's x-square test. Mean with 95% confidence equals 245,000, plus or minus 40,000, colonies/gram dry sediment (transformed — 228,000 plus or minus 20,400) from fresh samples. Variance between replicate filters was negligible. Most remaining variance was between samples; conversion of counts to weight basis introduced negligible variance. Counts from frozen samples were less variable than those from fresh samples. Fresh and frozen counts correlated well after transformation. Freezing confirmed as a method of preserving sediment for bacterial counts. Distribution in sediment of bacteria detected by these counts was slightly overdispersed (aggregated). Chromogenic colonies were prominent in the counted flora and directed attention to the possible role that interaction between organisms plays in counts of this nature, including antibiosis. (Jones-Wisconsin)
W71-03029

THE ROLE OF ESTUARIAN SEDIMENT MICROORGANISMS IN THE UPTAKE OF ORGANIC SOLUTES UNDER AEROBIC CONDITIONS,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Lindsay W. Wood.
Ph D Thesis, Dep of Zoology, North Carolina State University, Raleigh, 1970. 75 p, 63 fig, 14 tab, 71 ref. B-004-NC (2), B-020-NC (1).

Descriptors: *Estuaries, *Sediments, *Microorganisms, *Organic matter, *Kinetics, Solutes, Aerobic conditions, North Carolina, Depth, Seasonal, Enzymes, Carbon radioisotopes, Turnovers, Velocity, Respiration, Sampling, Mathematical studies, Phytoplankton, Primary production, Interfaces, Biomass, Algae, Aquatic plants, Temperature, Ecosystems, Salinity, Organic matter, Benthic fauna, Bacteria, Yeasts, Protozoa.
Identifiers: *Uptake, Pamlico Sound (NC), Glucose, Acetate, Dry weight, Transport constant, Protists, Spirostomum.

A previously used method of measuring uptake of radioisotopes in the water column to determine activity of bacterial populations is modified by dilution with substrate free water, thus slowing reaction, allowing replicate sampling, and produced reasonable filtration rates. Because uptake can be described by Michaelis-Menten kinetics, measurement of maximum velocity, turnover time, and a transport constant is possible on diluted samples. The true velocity, providing actual uptake rate requires a determination of natural substrate concentrations in sediment. Maximum uptake velocity was proportional to microbial biomass in water column. By doubling biomass, maximum velocity should be doubled. Consequently, correcting for amount of dilution produced an estimate of maximum velocity in sediments; however bacterial cell aggregations at high densities might influence results. Turnover times depend not only on uptake velocity, but also on natural substrate concentration. Loss of labeled carbon dioxide in sediments was lower than in water column, perhaps due to fermentative utilization of substrate. Algal blooms and aquatic vascular plant decay appeared to affect sediment microbial activity. The method needs testing under conditions paralleling microbial environments together with determination of forms involved in uptake of labeled compounds and fate of substrate fermentation products. (Jones-Wisconsin)
W71-03043

MALATHION: CHRONIC EFFECTS ON ESTUARINE FISH,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05C.
W71-03061

EFFECTS OF PROLONGED EXPOSURE TO SEVIN ON AN ESTUARINE FISH, LEIOSTOMUS XANTHURUS LACEPEDE,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05C.
W71-03062

THE ESTUARINE VERSION OF THE COLHEAT DIGITAL SIMULATION MODEL,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 06A.
W71-03070

MATHEMATICAL MODELING OF GULF COAST ESTUARIES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03074

A SUCTION PIPE FOR SAMPLING MIDWATER AND BOTTOM ORGANISMS IN THE SEA,
SACLANT ASW Research Centre, La Spezia (Italy).
For primary bibliographic entry see Field 07B.
W71-03080

APPLICATIONS OF ENVIRONMENTAL SATELLITE DATA TO OCEANOGRAPHY AND HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 07B.
W71-03085

LITTORAL ENVIRONMENT OBSERVATION PROGRAM IN CALIFORNIA, PRELIMINARY REPORT FEBRUARY-DECEMBER 1968,
Army Coastal Engineering Research Center, Washington, D.C.
Andre Szuwalski.

Available from NTIS as AD-704 720, $3.00 in paper copy, $0.95 in microfiche. Miscellaneous Paper No. 2-70, February 1970. 242 p.
Identifiers: *Seacoast, *Ocean currents, *Oceanographic data, Data processing systems, Beaches, Erosion, Tides, Wind, Ocean waves, Transport properties, Protection, Continental shelves, California, *Littoral Zone, Littoral currents, Rip currents, Surf, Beach cusps.

The report describes the Littoral Environment Observation (LEO) Program, and assembles in one paper the data collected under the program from February through December 1968. LEO is a cooperative effort of the State of California and the Corps of Engineers to collect information which will increase understanding of the littoral processes and physical characteristics of the California shore. The littoral variables collected under the LEO program include the following beach characteristics: foreshore slope, width and evaluation of berm, presence of cusps, and samples of the sediments. The beach samples are analyzed for mean and median diameter, standard deviation, skewness, and kurtosis. Sea variables include tide level, wave height, wave period, wave direction, type of breaker, direction and velocity of littoral currents, presence of rip currents, and water temperature. Wind velocity and direction are recorded, and panoramic photographs are obtained. The objective is to establish a bank of repetitive, systematic measurements of meteorological and oceanographic forces affecting the shoreline and the response of the shore to these forces. The data collected are being used as a base to analyze physical characteristics of the shoreline and the littoral processes affecting it.
W71-03088

OIL SLICK MOTION NEAR CHESAPEAKE BAY ENTRANCE,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 05B.
W71-03123

CENTRAL OREGON COAST, VOLUME I. PHYSICAL CONDITIONS AND PRESENT DEVELOPMENT.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03199

CENTRAL OREGON COAST. VOLUME II. ECONOMIC PATTERNS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03200

CENTRAL OREGON COAST, VOLUME III, FOREST PRODUCTS INDUSTRY.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03201

CENTRAL OREGON COAST. VOLUME IV. AGRICULTURE.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03202

CENTRAL OREGON COAST, VOLUME V. COMMERCIAL FISHING AND FISH PROCESSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03203

CENTRAL OREGON COAST. VOLUME VI. RECREATION TOURISM.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03204

CENTRAL OREGON COAST. VOLUME VII. POPULATION AND HOUSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03205

CENTRAL OREGON COAST. VOLUME VIII. TRANSPORTATION AND UTILITIES.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03206

CENTRAL OREGON COAST. VOLUME IX: DEVELOPMENT PROBLEMS AND POTENTIALS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03207

ESTUARINE CONSERVATION LEGISLATION IN THE STATES (AN EXAMINATION OF SOME EXISTING LEGISLATION AND SOME PROPOSALS),
For primary bibliographic entry see Field 06E.
W71-03298

PROPOSED SYSTEMS OF COASTAL ZONES MANAGEMENT: AN INTERIM ANALYSIS,
Gary H. Knight.
Natural Resources Lawyer, Vol 3, p 599-619, 1970.

Descriptors: *Federal government, *Coasts, *Federal project policy, *Legislation, Population, Community development, Distribution patterns, Growth rates, Legal aspects, Jurisdiction, Administrative agencies, Financing, Cost allocation, Cost sharing.

The high rate of population in the nation's coastal zones has led to a series of studies and recommendations for efficient management of this critical resource area. The report of the Commission on Marine Science, Engineering, and Resources and various Senate and House bills are examined, considering their contrasting proposals for: (1) establishment of state coastal zone authorities to manage development of their respective zones; (2) the proper federal agency to coordinate the zone authorities; (3) sanctions to be used by the federal agency to enforce its policies; (4) policy objectives of the project; (5) requirements for state participation and funding; and (6) problems arising from the current definition of 'coastal zone,' with respect to both seaward and inland boundaries. After discussing the status of the various bills in Congress, the author concludes that the programs proposed are generally sound, but he suggests several areas for improvement. It is recommended that comments upon the various proposals be forwarded to Washington for inclusion in the congressional bills. (Hart-Florida)
W71-03299

A CAPSULE HISTORY AND THE PRESENT STATUS OF THE TIDELANDS CONTROVERSY,
For primary bibliographic entry see Field 06E.
W71-03300

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

BRINE DISPOSAL POND MANUAL,
Bureau of Reclamation, Denver, Colo. Engineerin
Research Center.
For primary bibliographic entry see Field 05E.
W71-02950

TRANSPORT OF SALTS AND WATER ACROS A CATION EXCHANGER UNDER A GRADIEN OF HYDROSTATIC PRESSURE,
Aberdeen Univ. (Scotland).
Patrick Mears, and Terence Foley.
For sale by the Superintendent of Documents, U.S Government Printing Office, Washington, D.C 20402 Price $1.50. Office of Saline Wate Research and Development Progress Report No 584, December 1970. 175 p. OSW Grant 14-01 0001-638.

Descriptors: *Membranes, *Permselective mem branes, Electrodialysis, Osmosis, *Semipermeabl membranes, *Ion transport, Ion exchange, Revers osmosis, Desalination.
Identifiers: *Piezodialysis, *Pressure dialysis.

Each of the membrane models studied has given a estimate of all of the phenomenological coeff cients required for predicting the operating charac teristics of an electrolytic or piezodialytic desaltin process employing ion-exchange membranes. A fundamental discussion of the mechanism of tran port and coupling processes in the cation-exchang membrane Zeo-Kurb 315 is given. The work ca ried out in this program has completed the develop ment of techniques for the characterization of ion exchange membranes using irreversible ther modynamics. A detailed interrelation of the chem cal and physical structures of membranes with the transport properties must however await the deter mination of complete sets of phenomenologica coefficients on a wide variety of well-characterize membranes. (Kindley-Office of Saline Water)
W71-02951

VACUUM FREEZING VAPOR-COMPRESSIO PROCESS: 60,000 GPD PILOT PLAN EVALUATION,
Colt Industries, Inc., Beloit, Wis.
J. H. Fraser, and D. K. Emmermann.
For sale by Superintendent of Documents, U.S Govt. Printing Office, Wash., D.C. Price $1.00. Of fice of Saline Water Research and Developmen Progress Report No. 573, July 1970. 108 p, 22 fi 9 ref. OSW Contract 14-01-0001-532.

Descriptors: *Desalination processes, *Freezin Pilot plant, Desalination.
Identifiers: *Vacuum freezing, Direct melting.

Colt Industries first began development of th Vacuum-Freezing Vapor Compression (VFVC desalting process in 1960. Under OSW sponsor ship, beginning in 1965, the capacity of its pilo plant was increased from 60,000 to 120,000 gp and the power consumption reduced from 65 to 4 KWH/1000 gallons. Significant improvements wer made by increasing surface area of freezer, increas ing the efficiency of the vapor compressor developing a better method of brine drainage fro the wash column, and developing a more efficien method of remaining heat from the process. A direct melting concept in which washing and melt ing processes were combined in the same chambe was extensively evaluated. However, the result were inconclusive at the pilot plant stage of testing (Rinne-Office of Saline Water)
W71-02952

NDUSTRIAL BY-PRODUCT RECOVERY BY
ESALINATION TECHNIQUES.
qua-Chem, Inc., Waukesha, Wis.

or sale by the Superintendent of Documents, US
overnment Printing Office, Washington, DC
0402. Price: $2.50. Office of Saline Water
esearch and Development Progress Report No
81, October 1970. 314 p, 12 fig, 33 ref, append.
SW Contract 14-01-0001-2103.

escriptors: *Desalination, *Waste water treat-
ent, *Waste utilization, *By products, Distilla-
on, Reverse osmosis, Electrodialysis, Industrial
ater, Costs, *Industrial wastes.
dentifiers: Waste concentration, *Water renova-
on, *By products recovery.

study was made of the technical and economic
easibility of using desalination methods and equip-
ent for the recovery of materials from industrial
lant waste streams. It was determined that a very
ubstantial market for this equipment exists and
at desalination technology can convert many
aste disposal problems into paying recovery situa-
ons. It was estimated that over one billion dollars
desalination equipment could be utilized in vari-
us waste recovery and processing operations. The
ost promising industries are: SIC 26 - Pulp and
aper, SIC 202 - Cheese and Dairy, SIC 3312 - Iron
nd Steel, SIC 347 - Plating and Metal Finishing, -
uclear Power Plants, - Acid Mine Drainage.
Powell-Office of Saline Water)
V71-03004

EVERSE OSMOSIS FIELD TESTING ON ACID
INE WATERS AT NORTON, WEST VIR-
INIA,
ulf General Atomic, Inc., San Diego, Calif.
or primary bibliographic entry see Field 05D.
V71-03005

EVELOPMENT OF TUBULAR REVERSE OS-
OSIS MODULE ASSEMBLY TECHNIQUES,
erojet-General Corp., El Monte, Calif.
. A. Fluke.
or sale by the Superintendent of Documents, US
overnment Printing Office, Washington, DC
0402. Price: $1.00. Office of Saline Water
esearch and Development Progress Report 582,
ugust 1970. 78 p, 7 tab, 45 fig. OSW Contract 14-
1-0001-2163.

escriptors: *Desalination, *Reverse osmosis,
Membranes, *Membrane processes, Osmosis,
aste water treatment, Design, *Tubes, Porosity.

he development of the process and equipment for
he continuous production of porous wall reverse
smosis tubes lined with membrane material
eposited by extrusion warranted the development
f a chilled water membrane gellation system, of a
eliable and accurate tube length sizing apparatus,
f tooling and procedures for rapid installation of
ube end fittings, of a heat treat fixture permitting
imultaneous heat treatment of several reverse os-
osis tubes, of low- and high-pressure tube leak
heck and reverse osmosis test apparatus, of
rocedures for holding, alignment and positioning
f individual tube headers, and of techniques for
in-process' handling and storage of tubes. The five
asks performed were: to operate the production
ine for characterizing functions, control points of
he process, to determine the desalination per-
ormance of the tubular reverse osmosis elements,
o develop individual return bend shaped headers
ade from fiberglass reinforced plastic material, to
stablish quality assurance procedures and deter-
ine process reliability, and to optimize the struc-
ure of the fiberglass filament/resin composite
aterial of the porous reverse osmosis support
ube. (Mattson-Office of Saline Water)
W71-03006

SYSTEMS ANALYSIS OF BRINE DISPOSAL
FROM REVERSE OSMOSIS PLANTS,
Dow Chemical Co., Midland, Mich.

For primary bibliographic entry see Field 05E.
W71-03216

3B. Water Yield Improvement

EXPERIMENTAL INVESTIGATIONS AND COMPUTATION OF EVAPORATION FROM WATER SURFACE,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02D.
W71-02779

WATER UTILIZATION ASPECTS OF WEATHER MODIFICATION AS APPLIED TO KANSAS,
Kansas Water Resources Research Inst., Manhattan.
Robert L. Smith.
Available from NTIS as PB-196 310, $3.00 in paper copy, $0.95 in microfiche. Project Completion Report, November 1970. 64 p, 7 tab, 12 fig, 10 ref, 2 append. OWRR Project A-023-KAN (1).

Descriptors: *Hydrologic cycle, *Weather modification, *Water utilization, Rainfall, Runoff, Rainfall-runoff relationships, *Streamflow, Precipitation (Atmospheric), Kansas.
Identifiers: *Precipitation augmentation, Reservoir regulation.

A digital model of the land phase of the hydrologic cycle is utilized to determine the probable response of Kansas streams to various patterns of rainfall augmentation. Seven test basins, representing a broad range of climatic conditions, are analyzed. Comparative analysis of the results of simulations performed for historic and augmented patterns indicates runoff response would be most sensitive to changes in the precipitation pattern. In Kansas, the percentage increase in average streamflow will be approximately four times the percentage increase in average precipitation--assuming uniform aggmentation of the historic pattern. This estimated increase in average yield has to be discounted by about one half when allowance is made for practical operating constraints. The effects of randomness in the generation of augmented precipitation are explored in a limited way. Preliminary findings indicate random generation does not pose significant problems in appraising potential gains in stream yield. Justification for a statewide program of precipitation augmentation in Kansas would have to be highly dependent on benefits to dry land agriculture. The potential importance to other beneficial uses of water will, for the most part, be limited by the opportunity for reservoir regulation of the augmented flows. The percentage gain in gross sustaining yield of reservoirs will approximate the percentage gain in precipitation. An empirical relationship for determining the percentage gain in average runoff to be realized under conditions of uniformly augmented precipitation is presented. Data presented in the report suggest this relationship may be applicable to many areas of the nation.
W71-02827

STRUCTURE AND FUNCTION OF THE KIDNEY AND THE WATER BALANCE OF DESERT BATS,
San Diego State Coll., Calif. Dept. of Zoology.
For primary bibliographic entry see Field 02I.
W71-02866

REMOVAL AND INHIBITION OF CALCIUM SULFATE SCALE IN WATER FLOOD PROJECTS,
Dowell, Inc., Tulsa, Okla.
C. F. Smith, T. J. Nolan, III, and P. L. Crenshaw.
Journal of Petroleum Technology, Vol 22, No 11, p 1249-1256, November 1968. 21 ref.

Descriptors: *Scale prevention, *Descaling, Scaling, Calcium sulfate, Flooding, Oil well, Injection.
Identifiers: *Scale-removal agents, *Potential-scale inhibitors, Producing oil wells, Polyphosphate, Calcium orthophosphate, Cost-to-performance.

The problem of preventing calcium sulfate scale deposition has become increasingly important in the last few years due to the increasing use of waterflood as a means of secondary recovery. Many methods have been proposed for removing or preventing scale deposition. A few chemicals and treatment methods have been effective, but there are many ineffective scale-removal agents and inhibitors still on the market today. This paper describes the results of a laboratory testing program that evaluated potential-scale inhibitors and scale-removal agents. The paper also describes a field testing program in which various removal methods and inhibitor placement techniques were evaluated in 19 wells, and it compares field and laboratory results. (Campbell-NWWA)
W71-02986

WHEN NOT TO ACIDIZE,
Illinois State Water Survey, Urbana.
W. H. Walker.
Groundwater, Vol 5, No 2, p 36-40, April 1967. 2 tab, 4 fig, 4 ref.

Descriptors: *Acids, *Water wells, Illinois, Aquifer characteristics, Testing, Hydraulics.
Identifiers: *Acidizing, Water well development.

Controlled step and constant-rate pumping tests used by the Illinois State Water Survey to determine well efficiencies and hydraulic characteristics of aquifers showed that acidizing water wells to increase yield proved to be uneconomical method of well development or rehabilitation in some cases where aquifer permeability was low and normal operating head great, in wells affected by methane gas or where practical sustained yield of aquifer had been exceeded. Controlled pumping tests before, during and after development are necessary to accurately evaluate effectiveness of rehabilitation methods employed. Geologic definition of aquifers and records of pumpage and water level information are invaluable aids. (Campbell-NWWA)
W71-02989

EFFECT OF PRESSURE DRAWDOWN ON CLEAN-UP OF CLAY-OR SILT-BLOCKED SANDSTONE,
Union Oil Co. of California, Brea.
R. F. Krueger, L. C. Vogel, and P. W. Fischer.
Journal of Petroleum Technology, Vol 19, No 3, p 397-403, March 1967. 13 ref, 6 fig.

Descriptors: *Oil wells, *Aquifers, *Permeability, Drilling fluids.
Identifiers: *Temporary permeability reduction, Permeability damage repair, Backflush treatment.

Laboratory experiments have shown that restriction of oil flow rates during clean-up of water sensitive sandstone invaded with fresh water or filtrate from fresh water-base drilling fluid can materially reduce the amount of permeability damage. High rate clean-up of similar sandstone cores resulted in significantly higher damage. Attempts to repair permeability damage in cores through use of an oil backflush followed by low-rate reverse oil flow were only partially successful. Clean-up methods were usually ineffective for removing permeability damage in the Berea Sandstone. Clean-up of temporary permeability damage in clastic aquifer supplying domestic water supplies can be done via similar reasoning. (Cambell-NWWA)
W71-02992

DON'T UNDERESTIMATE ROLE OF AEROBIC BACTERIA,
G. A. Trautenberg.
The Oil and Gas Journal, Vol 63, No 1, p 85-87, January 4, 1965.

Descriptors: *Bacteria, *Sulphur bacteria, *Aerobic bacteria, Anaerobic bacteria, Ferrobacillus, Iron bacteria, Pseudomonas, Corrosion, Waterflood, Water chemistry, Chemical analysis, Oil industry, California.
Identifiers: *Sulfate-reducing bacteria, *Desulfovibrio, Slime-forming bacteria, Bacillus.

In examining water sample data from a southern California produced-water injection system, a close correlation between the aerobic bacterial counts and the sulfate-reducing bacteria counts was observed. The biocide treatment previously in use was intended to be specific for sulfate-reducing bacteria. The biocide had little effect against the aerobic population and consequently its activity against the sulfate-reducers was negligible. In contract, bacterial counts from the same sampling points being treated with the same level of a different biocide were reduced significantly. The aerobic bacteria isolated from this system were species of Flavobacterium, Alcaligenes, Proteus, and Bacillus. (Campbell-NWWA)
W71-02996

MATRIX ACIDIZING CORRECTS FORMATION DAMAGE IN SANDSTONES,
Dow Chemical Co., New Orleans, La.
W. M. Ross, N. O. Pierson, and A. W. Coulter.
Petroleum Engineer, Vol 35, No 12, p 64-69, November 1963. 1 tab, 4 fig, 3 ref.

Descriptors: *Acids, *Oil wells, *Water wells, Louisiana, Testing, Aquifer characteristics, Hydraulics, Drilling, Oil industry, Drilling fluids.
Identifiers: *Acidizing, *Water well development, *Formation damage matrix acidizing, Mud acid treatments, Granular synthetic polymer, Hydraulic acid fracturing, 'Skin effect'.

Matrix acidizing is a relatively new, but field-proven, technique to correct producing formation damage incurred while drilling or cementing sandstones. It is a result of two significant modifications in conventional mud acid treatments to overcome 'skin effects' around well bore. A granular synthetic polymer is discussed which swells upon contact with acid and serves as an effective fluid loss control additive. Another principal change in mud acidizing is in the application of controlled injection pressures. Using this approach has a reported success ratio of 78% in over 100 wells treated. (Campbell-NWWA)
W71-03000

CLOUDS AND PRECIPITATION IN THE TEXAS HIGH PLAINS,
Texas Tech Univ., Lubbock. Dept. of Geosciences; and Texas Univ., Austin. Atmospheric Science Group.
For primary bibliographic entry see Field 02B.
W71-03128

SOIL WATER EVAPORATION: FIRST STAGE DRYING AS INFLUENCED BY SURFACE RESIDUE AND EVAPORATION POTENTIAL,
Agricultural Research Service, Mandan, N. Dak. Soil Water Conservation Research Div.
For primary bibliographic entry see Field 02D.
W71-03141

3C. Use of Water of Impaired Quality

THE TWICE-USED WATER,
For primary bibliographic entry see Field 02F.
W71-02959

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W71-02977

3D. Conservation in Domestic and Municipal Use

LAWN WATERING NEED NOT BE WASTEFUL,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02G.
W71-02976

BOARD OF SUP'RS V WATER POWER AND CONTROL COMM'N (REVIEW OF ORDER AUTHORIZING NEW MUNICIPAL WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-03249

3E. Conservation in Industry

INDUSTRIAL BY-PRODUCT RECOVERY BY DESALINATION TECHNIQUES.
Aqua-Chem, Inc., Waukesha, Wis.
For primary bibliographic entry see Field 03A.
W71-03004

A CRITIQUE OF FEDERAL WATER RESOURCES POLICIES: HYDROELECTRIC POWER VERSUS WILDERNESS WATERWAY ON THE UPPER MISSOURI RIVER,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 06B.
W71-03016

3F. Conservation in Agriculture

THE IMPORTANCE OF RAINFALL AND SOIL MOISTURE IN THE AGRICULTURAL DEVELOPMENT OF THE CLOSED FOREST ZONE OF GHANA,
G. Benneh.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 467-478, July 1970. 12 p, 8 fig, 9 ref.

Descriptors: *Water balance, *Agriculture, *Forest soils, Foreign projects, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Meteorology, Climatology, Precipitation (Atmospheric), Runoff, Vegetation, Forests, Soil moisture, Hydrologic data, International Hydrologic Decade.
Identifiers: *Ghana.

The importance of rainfall and soil moisture in the agricultural development of the forest region of Ghana is discussed. Lack of water is not often regarded as one of the agricultural problems there because of the high mean annual rainfall figures. The distribution of rainfall in time and space is examined in an attempt to underline the detrimental aspects of the rainfall conditions. The soil moisture of the region is calculated and its relevance to agricultural practice is discussed. Graphs comparing the mean monthly water need and the average monthly rainfall of selected stations in the region are included. (Woodard-USGS)
W71-02794

A SHORT STUDY ON CONSUMPTIVE USE AND THE DATA REQUIRED IN IRAN,
Iran Plan Organization, Tehran. Water Planning Group.
M. Vahidi, and Gh. Ghodratnama.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 421-437, January 1970. 17 p, 6 tab.

Descriptors: *Consumptive use, *Water, *Crops, *Foreign projects, Water resources, Water quality, Hydrologic data, Meteorological data, Plants, Leaves, Seasonal, Solar radiation, Temperature, Humidity, Winds, Equations.
Identifiers: *Iran, *Scarce data, Tables.

Various direct and indirect methods of determining water requirements for crops are presented that are relevant to soil, climatic, and hydrologic conditions in Iran. Full knowledge of the consumptive use of any crop, from time of seeding until harvest is necessary for the profitable irrigation of that crop. Once the consumptive use of the crops of an area is known, the acreage which can be irrigated by a given source of water may be estimated. Recently, a law to nationalize water resources was passed by the Iranian Parliament. A full knowledge of the consumptive use of crops is necessary to carry out this law, and to allocate water rights to each farmer. Factors involved include irrigation practices, length of growing season, precipitation, water at the plant's disposal, temperature, humidity of the air, wind movement, intensity and duration of sunlight, stage of development of the plant, type of foliage, and nature of the leaves. Grain, vegetable, melon, orchard, vineyard and other crop types are included in the study. (Woodard-USGS)
W71-02803

KHUZESTAN WATER RESOURCES APPRAISAL,
Khuzestan Water and Power Authority, Tehran (Iran).
For primary bibliographic entry see Field 04A.
W71-02808

LAND TREATMENT IN AGRICULTURAL WATERSHED HYDROLOGY RESEARCH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 04C.
W71-02812

KHAIRPUR TUBEWELL PROJECT,
West Pakistan Water and Power Development Authority, Lahore.
For primary bibliographic entry see Field 02G.
W71-02816

EXPORT OF MISSISSIPPI RIVER WATER TO TEXAS AND NEW MEXICO,
Bureau of Reclamation, Austin, Tex.
For primary bibliographic entry see Field 06B.
W71-02852

PLAINS PRICKLYPEAR: RELATION TO GRAZING INTENSITY AND BLUE GRAMA YIELD ON CENTRAL GREAT PLAINS,
Agricultural Research Service, Fort Collins, Colo. Crops Research Div.
R. E. Bement.
Central Plains Experimental Range, Crops Research Division, Agricultural Research Station, U.S.D.A. and the Colorado Agricultural Experiment Station, Scientific Paper No. 1197. Journal of Range Management, Vol 21, No 2, p 83-85, March 1968. 1 fig, 2 tab, 7 ref.

Descriptors: *Cacti, *Grama grasses, *Great Plains, *Range management, *Grazing, On-site investigations, Precipitation (Atmospheric), Semiarid climates, Microenvironment, Cattle, Ecology, Insects, Forage grasses, Terrestrial habitats, Mode of action, Environmental effects, Grasslands, Xerophytes, Colorado, Loam, Variability, Range grasses, Pasture management, Crop production.
Identifiers: *Pricklypear, Plots.

Extensive infestation of Central Great Plains rangelands by pricklypear (Opuntia polyacantha Haw.) has often been considered an effect of heavy livestock grazing. Three upland-grama range pastures were grazed, respectively, at light, moderate and heavy intensities (1.79, 3.13 and 4.11 acres/yearling heifer per month) from 1940-1964. Records were kept of annual precipitation and changes in pricklypear cover as a percentage of initial cover in 1940. The cover on all pasture in-

reased over 100% by 1964, with the greatest increase occurring on the light-use pasture and the ast on the heaviest pasture. Cover percentages ever exceeded 2.4% and 85% of the variation was ssociated with yearly precipitation changes. ariations in pricklypear abundance seem to be ue to soil conditions in association with climatic nd biotic factors. Changes in grazing intensity can- ot therefore be depended upon as pricklypear anagement practices. From 1960-1965, 3 sets of djacent paired lots on Ascalon and Shingle soils ere assayed for blue-grama production in which e pricklypear of one member of each pair were moved. The mean yield from the control plots as not significantly different from the experimenl plots. (Casey-Arizona)
71-02860

ORAGE POTENTIAL OF IRRIGATED BLUE RAMA WITH NITROGEN FERTILIZATION,
outhwestern Great Plains Research Center, ushland, Tex.
or primary bibliographic entry see Field 02G.
71-02861

HE CIMARRON NATIONAL GRASSLAND: A TUDY IN LAND USE ADJUSTMENT,
orthern Illinois Univ., De Kalb. Dept. of Geogphy.
Ross Guest.
ournal of Range Management, Vol 21, No 3, p 67-170, May 1968. 3 fig, 2 tab, 5 ref.

escriptors: *Habitat improvement, *Semiarid climates, *Range grasses, *Land management, *Land se, Productivity, Range management, Wildlife anagement, Recreation facilities, Economic imact, Economic justification, Planning, Food and over crops, Wildlife habitat, Kansas, Great Plains, orage grasses, Ecosystems, Water conservation, razing, Rainfall, Loam, Land reclamation, evegetation, Wind erosion, Soil erosion, Erosion ontrol, Federal government, Education, ivestock, Multiple purpose projects.
dentifiers: *Cimarron National Grassland, Cimarron River, National Grasslands, Submarnal land.

1934, the U.S. Department of Agriculture iniated a program of submarginal farmland and ranland purchases. These lands, mostly in plains ates were transferred to the Forest Service for ermanent retention and management and became ne National Grasslands system. The Cimarron Naonal Grassland is located in the Cimarron River alley of semiarid southwestern Kansas. When riginally purchased in the 1930's, these lands had uffered heavily from wind and water erosion due agricultural mismanagement. Most of the plant over on the rangeland had been destroyed either y overgrazing or dust deposition. Where possible, ne land was seeded to sorghum and broom corn, nd by 1943 a number of forage grasses had ecome well enough established to justify grazing. urrently, the area is grazed by about 3500 head of attle yielding a $15,000/year income. Additionally, wildlife habitats and picnicking areas have een developed to the extent that hunting and ecreation have become major usages of the Grassand. It is felt that intangible returns such as educaonal and recreational values as well as tangible eturns such as grazing fees which are redistributed the county, have proven the utility of governent management of marginal lands. (Casey-rizona)
71-02862

SENSITIVE CUP-TYPE ANEMOMETER,
Vashington Univ., Seattle.
or primary bibliographic entry see Field 07B.
71-02864

LFALFA FOR FORAGE PRODUCTION IN RIZONA,
rizona Agricultural Experiment Station, Tucson.
or primary bibliographic entry see Field 02G.
W71-02868

IRRIGATION PRACTICES AND COSTS IN NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Agricultural Economics.
Wallace McMartin, and Ronald O. Bergan.
North Dakota State University, Fargo, Agricultural Experiment Station, Bulletin No 474, March 1968. 48 p, 30 tab, 13 fig, 3 ref.

Descriptors: *Irrigation operation and maintenance, *Irrigation systems, *Cost comparisons, *Evaluation, *North Dakota, Sprinkler irrigation, Irrigation water, Application methods, Surface irrigation, Distribution systems, Irrigated land, Soil moisture, Economic efficiency, Data collections, Pipes, Return (Monetary), Crop production, Farm equipment, Land use, Water requirements, Semiarid climates, Labor, Soil texture, Surveys.
Identifiers: *Mechanical sprinklers, *Self-propelled systems, Hand-move sprinklers, Gated pipe, Tow-line system, Boom system, Wheel-move system.

Irrigation is developed in North Dakota to stabilize the feed supply for existing livestock. This study forms a basis for an economic evaluation of several types of irrigation systems with respect to crop requirements and descriptive information on operating characteristics. Mechanical sprinklers (two-line, boom, wheel-move, self-propelled), hand-moved sprinklers, gated pipe, and conventional surface irrigation systems are evaluated. Eighty farmers' interviews provided the data. Mechanically-moved systems used well water, while other systems used surface water. Irrigation water is used on one or two crops, usually alfalfa and corn silage, or wheat and corn grains. Beef cattle and large acreages of dry cropland were produced. The average investment for self-propelled, two-line, wheel-move and boom systems were $25,452, $13,796, $13,149 and $9,266 per farm. Pipe and sprinkler equipment were large investments for sprinkler systems. Land leveling was the major cost in surface systems. Sprinkler system costs varied from $2.28 per acre for booms to $5.98 per acre for self-propelled systems, though self-propelled systems have low labor costs. Other costs include field labor, fertilizer, seed and spray, and machine costs. Soil-moisture detection methods are also discussed. Tables and figures describe irrigation systems, costs, locations, use, frequency, crops, mechanical features, cultural practices and soil textures. (Popkin-Arizona)
W71-02870

BARLEY--DATES AND RATES OF PLANTING,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02I.
W71-02872

EFFICIENT LETTUCE PRODUCTION DEMANDS CRITICAL FERTILIZER MANAGEMENT,
Arizona Agricultural Experiment Station, Tucson.
B. R. Gardner, and W. D. Pew.
Progressive Agriculture in Arizona, Vol 22, No 4, p 8-9, July-August 1970.

Descriptors: *Fertilizers, *Lettuce, *Cultural control, *Nitrogen, *Arizona, Arid lands, Plant growth regulators, Soil-water-plant relationships, Temperature, Color, Irrigation practices, Leaching, Crop production, Planting management, Weight, Nitrates, Growth rates, Nutrients.
Identifiers: *Nitrogen deficiency, *Nitrogen fertilization.

Efficient production of quality head lettuce results from the proper management of many cultural practices. Nitrogen fertilization is a practice that has a remarkable effect on lettuce growth, over which the grower has control. More fertilizer is applied to lettuce in Arizona than any other vegetable crop. An understanding of the growth pattern of the lettuce plant and ways in which nitrogen fertilizer affects this growth is evaluated through a 5-year plant tissue analysis program of the University of Arizona and the Bruce Church Company of Yuma, Arizona. Temperature has a marked effect on lettuce growth rate. About 80 percent of the total lettuce dry weight is produced during the heading period, where 80 percent of the nitrogen is applied. Nitrogen fertilizer applied in the nitrate form at planting time is extremely susceptible to loss by irrigation leaching. The most efficient program includes smaller fertilizer applications during vegetative growth. Nitrogen deficiency has detrimental effects on color and ribbiness. Incidence of pink rib, rib discoloration, rust spotting, slime mold and pith condition are not associated with nitrogen supply or source. There is a photograph showing the effects of nitrogen on lettuce heads. (Popkin-Arizona)
W71-02873

EVALUATION OF ACARICIDES FOR CONTROL OF THE STRAWBERRY SPIDER MITE ON COTTON AND ALFALFA,
Arizona Univ., Tucson. Agricultural Extension Service.
T. F. Watson, D. G. Fullerton, Leon Moore, D. M. Tuttle, and James Hazlitt.
Progressive Agriculture in Arizona, Vol 22, No 4, p 14-16, July-August 1970. 2 tab, 2 fig.

Descriptors: *Acaricides, *Pest control, *Mites, *Cotton, *Alfalfa, Arizona, Arid lands, Rates of application, On-site tests, Treatment, Growth stages, Insecticides, Eggs, Immature growth stage, Mature growth stage.
Identifiers: *Strawberry spider mite, Azodrin, Acaralate, Chlorobenzilate, G.S. 19851, Galecron.

Small-plot field tests were conducted at Parker, Arizona, to evaluate effectiveness of several acaricides against the strawberry spider mite, Tetranychus turkestani U. and N., on cotton and alfalfa. Populations were high enough by early May so that leaf damage was evident. This research was to obtain information relative to control of the mite on seedling cotton. Azodrin, Acaralate, Chlorobenzilate, G.S. 19851, and Galecron reduced the egg, immature and adult, stages by 90 to 100 per cent in the 7-day post-treatment counts. Alfalfa experiment results generally agree with those obtained on cotton. Azodrin, Acaralate, Chlorobenzilate and Galecron gave the most satisfactory spider mite control for both cotton and alfalfa. Tables show influence of 12 acaricides on mite populations on cotton and alfalfa for 1969 tests. Figures show an arbitrary classification of several acaricides relative to their mite-control effectiveness on cotton and alfalfa. (Popkin-Arizona)
W71-02875

THE IMPACT OF DIFFERENT LEVELS OF WATER DEVELOPMENT ON TEXAS AGRICULTURE,
Texas Agricultural Experiment Station, College Station.
Fred A. Schmer, Warren L. Trock, and Glen L. Wistrand.
Texas A and M University, Texas Agricultural Experiment Station, MP-911, March 1969. 42 p, 40 tab, 2 fig, 8 ref. OWRR Project A-001-TEX, B-005-TEX.

Descriptors: *Economic impact, *Water resources development, *Agriculture, *Evaluation, *Texas, Water resources, Water requirements, Water demand, Resource allocation, Social aspects, Monetary benefits, Water supply, Crop production, Water shortage, Consumptive use, Irrigation practices, Arid lands, Resource development, Planning, Data collections, Model studies, Irrigated land, Forecasting, Economic prediction, Constraints, Dry farming, Land development.
Identifiers: *Commodity requirements, *Resource availability, *Agricultural changes, Economic models, Economic limitation, Reduction, Commodity output.

Present and future agricultural production in Texas is discussed in this report, where normalized 1964 data (resource availability, agricultural yield production and commodity requirements) are projected to 2020. Four models of irrigated acres and future trends, considering resource use and commodity output, are developed and analyzed. The models vary from assuming unlimited water supplies, economic limitations on irrigated production, realistic resource analysis and projected resource development. This study estimates the impact of water resources development on the $6.3 billion agricultural industry. Water, required in hugh quantities for agriculture, is critical to the economy. Approximately 16 million acre-feet of water for municipal, industrial, agricultural and mining purposes was used in 1965. Eighty percent of this water was used on irrigated crops worth $675 million. Irrigated crop production was the basic economy in some areas. At existing cost, there is the prospect of water shortages and reduction in agricultural production. If costs are not reduced, or additional water supplies are not developed, areas suffering water supply declines will suffer economic and social loss. Water planning, present and future agriculture, markets and resources, changes in agriculture and the four models are analyzed. Forty tables show current and projected resources and status of agriculture using the four models. (Popkin-Arizona)
W71-02876

A SOIL WATER MODEL FOR TWO CONTRASTING TILLAGE SYSTEMS,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
For primary bibliographic entry see Field 02G.
W71-02883

METHODS FOR THE STUDY OF WATER BALANCE OF IRRIGATED LANDS AND IRRIGATION SYSTEMS,
State Hydrological Inst., Leningrad (USSR).
S. I. Kharchenko, and D. M. Katz.
In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 452-458, July 1970. 7 p, 1 tab, 6 ref.

Descriptors: *Water balance, *Irrigated land, *Methodology, Hydrologic cycle, Hydrologic budget, Synoptic analysis, Surface waters, Groundwater, Hydrologic data, Climatology, Meteorology, Precipitation (Atmospheric), Vegetation, Soil moisture, Evpotranspiration, Water table, Salinity, Equations, International Hydrological Decade.
Identifiers: USSR.

Methods developed for water balance studies on reclaimed irrigated lands in the USSR are discussed. A variety of physiographical conditions contributed to the development of different approaches to the methods for water balance investigations and computation. Relations between pedological, chemical, hydrogeological, physiological as well as meteorological and energy processes taking place in the soil-water-plant-atmosphere system are important factors. On the basis of the established relations it becomes possible first to evaluate and then to forecast such processes as secondary salinization, swamping, etc. and also to project more effective engineering measures of prevention and control of these phenomena. A brief account of methods for determination of the components of equations used in the USSR is given. (Woodard-USGS)
W71-02910

IRRIGATION: WHEN-HOW MUCH-HOW,
Arizona Univ., Tucson. Cooperative Extension Service.
For primary bibliographic entry see Field 02G.
W71-02958

ARIZONA AGRICULTURE 1970.
Arizona Univ., Tucson. Dept. of Agricultural Economics.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-70, April 1970. 32 p, 16 tab, 3 fig, 19 ref.

Descriptors: *Arizona, *Costs, *Agriculture, *Income, *Crop production, Water resources, Groundwater, Surface runoff, Surface waters, Prices, Programs, Resource development, Labor, Credit, Field crops, Citrus fruits, Vegetable crops, Melons, Livestock, Arid lands, Cotton, Grains (Crops), Pumped storage, Withdrawal, Water levels, Economic impact, Rural areas, Fruit crops, Poultry.
Identifiers: *Agricultural policy, *International trade programs.

This 40th annual issue discusses costs, income, and production in Arizona agriculture. There are sections on agricultural prices and policy, commodity programs, resource use, economic development, water, labor, agricultural credit, international trade programs, field crops, citrus, grapes, vegetables, melons, livestock and livestock products, and principal Arizona crops in 1969. Arizona's agriculture depends largely on water management. Total surface water diversions and groundwater pumpage during the 1968 water year was 7,799,000 acre/feet, a near record high. About 3,350,000 acre/feet, a record high, was diverted from streams. Groundwater pumpage was about 4,449,000 acre/feet. The decline in statewide water pumped was a result of declines in the Salt River (500,000 acre/feet) and Santa Cruz River Valleys (200,000 acre/feet). There were ample supplies of surface water storage beginning in 1970 as a result of unusually favorable runoff conditions. (Popkin-Arizona)
W71-02960

SALT CONCENTRATIONS IN SOILS FURROW-IRRIGATED WITH SALINE WATERS,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 02G.
W71-02961

GRAIN SORGHUM ROW SPACING AND PLANTING RATES UNDER LIMITED IRRIGATION IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plain Research Center.
J. T. Musick, and D. A. Dusek.
Texas A and M University, Texas Agricultural Experiment Station, Miscellaneous Publication 932, October 1969. 10 p, 5 tab, 6 fig, 13 ref.

Descriptors: *Sorghum, *Irrigation efficiency, *Spatial distribution, *Planting management, *Rates, Crop production, Crop response, Plant growth, Irrigation practices, Texas, Arid lands, Rainfall, Seasonal, Water utilization, Timing, Plant populations, Lodging, Soil-water-plant relationships, Water conservation.
Identifiers: *Row spacing, Limited irrigation, Texas High Plains.

As groundwater irrigation supplies become more scarce, the limited irrigation approach will become widely used. A 3-year experiment involving row spacing, planting rates, and number and timing of irrigations was conducted at Bushland, Texas, during 1963-1965. Double-row spacing (two 12-inch rows on 40-inch beds) and higher plant populations substantially increased stalk lodging on limited irrigation. The efficiency of one 4-inch seasonal irrigation was substantially increased by double-row spacing. Maximum response ranged from 780 to 820 pounds per acre each year and averaged 800 pounds per acre, or a 16.6 percent increase. Figures show effect of row spacing on seasonal water use efficiency, grain yield and average plant height for various limited irrigation treatments on three stages of plant development. Tables indicate rainfall, field-surveyed practices, planting rate effects, crop yield and row-spacing effects on plant height. (Popkin-Arizona)
W71-02962

WATER USE BY IRRIGATED SUGAR BEET IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W71-02963

CHEMICAL WEED CONTROL FOR THE IRRIGATED AREAS OF ARIZONA, 1970.
Arizona Univ., Tucson. Cooperative Extension Service.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-1, Revised December 1969. 23 p, 3 tab, 7 ref.

Descriptors: *Weed control, *Chemcontrol, *Herbicides, *Application methods, *Arizona, Weed, Field crops, Vegetable crops, Fruit crops, Arid lands, Farm management, Rates of application, Irrigated lands, Sprays, Calibrations, Irrigation practices, Plant growth regulators, Movement, Mechanical control, Cultivation.
Identifiers: *Herbicide residues, Hand hoeing.

This bulletin summarizes suggestions for weed control practices using herbicides on Arizona irrigated croplands. These data are based on experience, reports from farmers, and research of the agricultural chemicals industry, the U. S. Department of Agriculture, and the University of Arizona. Herbicides can eliminate hand hoeing and may replace much mechanical cultivation. Proper use of herbicides is now a good farming practice. Herbicide must be used only as suggested on the container label, applied at the correct rate and used with caution. Herbicide residues in the soil, movement along irrigation runs and sprayer calibration techniques are outlined. A list of 37 common, trade and chemical herbicide names is given. A recommended use chart for herbicides includes field crops, vegetables and fruit and general vegetation control. A recommended use chart of herbicide for 10 specific weeds is also presented. (Popkin-Arizona)
W71-02964

GUIDE TO IMPROVEMENT OF ARIZONA RANGELAND.
Arizona Agricultural Experiment Station, Tucson.

University of Arizona, Cooperative Extension Service and Agricultural Experiment Station, Bulletin A-58, July 1969. 94 p, 35 fig, 4 tab, 2 ref.

Descriptors: *Range management, *Brush control, *Fertilization, *Arizona, *Desert plants, Arid lands, Soil texture, Topography, Burning, Seeds, Rates, Planting management, Plants, Shrubs, Range grasses, Grasslands, Maps, New Mexico, Biocontrol, Chemcontrol, Climatic zones, Grazing, Treatment, Timing, Application techniques, Mechanical control, Revegetation.
Identifiers: *Rangeland improvement, *Major Land Resource Areas (MLRA), *Environmental zones (EZ), Seeding.

This bulletin is a guide for ranchers and technicians in techniques of application and planning of range use, brush control, range seeding and range fertilization practices on Arizona rangeland. The guide is a basis for problems analyses and treatment recommendations. Maps identify environmental zones (EZ), major land resource areas (MLRA) topography and soil texture regions. Recommended practices are based on published data and experience. Arizona is divided into MLRA's with 27 EZ's. Each are shown on a map and by a typical photographic view. Proper range use is discussed in terms of management application. Biological, mechanical, chemical and burning methods o

rush control are described for 18 species. Range rtilization and seeding includes grazing manage- ent, seedbed preparation, fertilizer practices, and eding methods for 27 species. Tables include an ppendix of common and scientific specie names, rush control, range seeding and cultural-practices ecommendations. Thirty-five figures show maps nd photographs of MLR's and typical views and egetation. (Popkin-Arizona)
71-02965

STABLISHMENT AND MANAGEMENT OF RRIGATED PASTURES IN ARIZONA,
rizona Univ., Tucson. Cooperative Extension Ser- ce.
. E. Dennis.
niversity of Arizona, Cooperative Extension Ser- ce and Agricultural Experiment Station, Bulletin -49, Reprinted July 1969. 35 p, 27 fig, 4 tab, 3 f.

escriptors: *Pasture management, *Arizona, Vegetation establishment, *Irrigated land, Range anagement, Pastures, Land management, Weed ntrol, Timing, Carrying capacity, Grasses, egumes, Range grasses, Fertilization, Irrigation, levation, Soil moisture, Rotations, Soil conserva- n, Fescues, Bermuda grass, Arid lands, Seeds, arieties, Grazing, Forages, Rates, Cattle, itrogen.
lentifiers: *Permanent pastures, Growing season, eed inoculation.

uggestions are given in this bulletin for establish- g and managing irrigated pastures such as rizona's 50,000 acres, where tall fescue grass, ermuda grass and alfalfa predominate. There are escriptions and requirements of 8 grasses and 5 gumes. Elevation, growing season length and soil etermine the optimum plant species. Information presented on legume seed inoculation with itrogen-fixing bacteria, seed quality, planting ates, seeding rates and methods, irrigation and rtilization. Also included are surface and sprin- ler criteria, where frequency is determined by soil nd temperature. Irrigated pastures can supple- ent range forage and are especially useful for razing cattle. They produce yields on soils too ine for field crops, supplement small farm in- ome and conserve and improve soil. Criteria for nd selection and preparation included considera- on of rotation grazing, irrigation-and livestock- ater availability, land leveling and seedbed oisture conditions. Stand-establishment cost, anagement of permanent pastures, carrying apacity and grass and legume comparisons are lso considered in this bulletin. There are 27 gures of irrigated pastures, plant species and cul- ural practices. (Popkin-Arizona)
71-02966

RIZONA AGRICULTURE 1969.
rizona Univ., Tucson. Dept. of Agricultural conomics.

niversity of Arizona, Cooperative Extension Ser- ice and Agricultural Experiment Station, Bulletin -57, March 1969. 26 p, 13 tab, 2 fig, 13 ref.

escriptors: *Arizona, *Costs, *Agriculture, *In- ome, *Crop production, Water resources, roundwater, Surface waters, Prices, Programs, esource development, Economic efficiency, valuation, Irrigated land, Water, Labor, Credit, ield crops, Citrus fruits, Vegetable crops, Melons, ivestock, Arid lands, Cotton, Grains (Crops), ruit crops, Pumped storage, Reservoir storage.
dentifiers: *Agricultural policy, Central Arizona roject.

his is the 39th annual issue on agricultural costs, ncome, and production in Arizona. Arizona's griculture depends largely on water management. otal surface-water diversions and groundwater umpage during the 1967 water year was ,986,000 acre/feet, more than any previous ecorded year. About 2,835,000 acre/feet were diverted from streams. Groundwater pumpage was about 5,151,000 acre/feet. Increased pumpage was due to newly developed groundwater irrigated areas. Congress passed and the President approved legislation authorizing federal planning and construction of the Central Arizona Project, which may deliver an excess of 2,000,000 acre/feet per year to Central Arizona. The Pacific Southwest Inter-Agency Committee and the U. S. Water Resources Council started a program of comprehensive reconnaissance river basin water planning studies. Included in this bulletin are sections on agricultural prices and policy, commodity programs, comprehensive community resource development, water, labor, agricultural credit, valuation of Arizona's privately owned agricultural lands, field crops, citrus, grapes, vegetables, melons, livestock and livestock products, and principal Arizona crops in 1968. (Popkin-Arizona)
W71-02967

THE INFLUENCE OF XYLEM ARRANGEMENT AND TRANSPIRATION ON THE DISTRIBUTION OF SOLUTES IN COTTON,
Texas A and M Univ., College Station. Dept. of Plant Sciences.
For primary bibliographic entry see Field 02D.
W71-02968

OPTIMUM PLANT POPULATIONS FOR IRRIGATED LATE COTTON PLANTINGS, TEXAS HIGH PLAINS,
Agricultural Research Service, Lubbock, Tex. Crops Research Div.
J. D. Bilbro, Jr.
Texas A and M University, Texas Agricultural Experiment Station, MP-900, November 1968. 7 p, 3 tab, 3 ref.

Descriptors: *Plant populations, *Cotton, *Varieties, *Crop production, *Variability, Soil-water-plant relationships, Time, Texas, Arid lands, Seeds, Plant growth, Rates, Planting management, Optimization, Mature growth stage, Height, Fibers (Plant).
Identifiers: *Lankart Selection 57, *Paymaster 101-A, *Irrigated crops, *Texas High Plains, Bolls.

A 5-year study from 1962-1965 provided data on the effects of planting rates on performance of Lankart Selection 57 and Paymaster 101-A irrigated cotton planted in early June. Highest yields were produced by planting rates of 30 and 18 pounds and by plant populations of 45,000 to 90,000 and 38,000 to 90,000 per acre for Lankart and Paymaster, respectively. Plant populations, yields and varieties for any planting rate were highly variable with time. Paymaster had higher planting populations than Lankart in 4 of the 5 years for any planting rate. Plant populations had little effect on grades, fiber length, strenth, elongation, micronaire fineness or earliness. Increased plant population decreased bolls per plant and plant height and increased lowest boll height. Tables show plant characteristics, cultural practices, and crop yields. (Popkin-Arizona)
W71-02969

PLANNING IN PLANT DISEASE PROGRAMS,
Pennsylvania State Univ., University Park. Whitmore Chemical Lab.
Richard D. Schein.
Agroclimatological Methods; Proceedings of the Reading Symposium, Natural Resources Research, Vol 7, p 141-151, UNESCO, 1968. 3 fig, 16 ref.

Descriptors: *Epidemiology, *Plant diseases, *Plant pathology, *Forecasting, *Pathogenic fungi, Crop response, Rates, Epidemics, Climatology, Rainfall, Temperature, Ecology, Germination, Dispersion, Irrigation effects, Arid lands, Dew, Winds, Microenvironment, Time lag, Time of concentration, Effective precipitation, Environmental effects, Mode of action, Mycology, Insects, Pest control, Planning, Economic efficiency, Phenology, Meteorological data.
Identifiers: *Agroclimatology, *Bioclimatology, *Aerobiology, *Exponential increase.

The prevention cost of plant diseases is today a significant cost of crop production in areas where phenology coincides with weather favorable for pathogens. It is therefore asserted that diseases require consideration in assessing the agricultural potential of an area by reference to meteorological data. In fungal plant diseases, inoculum arrival is followed by moisture-requiring temperature-dependent periods of germination, germ tube growth and colonization. Light effects may also be important. Epidemics may be either tardive or explosive. An explosive epidemic increases at a rate proportional to the initial magnitude (X sub 0), time and average infection rate (r). Anything having a reducing effect on X sub 0 or r will reduce the course of disease. Predisposition may be strongly influenced by temperature or humidity. The source of inoculum may be far away with spread occurring by climatological effects. It may therefore be important, when selecting a crop, to consider potential sources of the disease and prevailing weather patterns between the sites. Since moisture and temperature are critical factors in germination, crop seasons must be selected so that chances of repetitive rainy periods are minimal during critical infection time. In rainless arid areas, overhead irrigation and dew are sources of moisture for the infection process. Similar considerations with incubation and dispersal periods show that timing is the important factor in epidemiology. (Casey-Arizona)
W71-02973

WATER, SOIL, AND CROP MANAGEMENT PRINCIPLES FOR THE CONTROL OF SALTS,
Arizona Univ., Tucson. Dept. of Agricultural Chemistry and Soils.
For primary bibliographic entry see Field 02G.
W71-02977

RAINFALL DISTRIBUTIONS AND SIMULATION MODELS,
University of New England, Armidale (Australia).
For primary bibliographic entry see Field 02B.
W71-03071

SYMPOSIUM: COST BENEFIT ANALYSIS - SPATIAL AND TEMPORAL ALLOCATION OF IRRIGATION WATER: SOME POLICY MODELS AND EXAMPLES,
University of New England, Armidale (Australia); and Guelph Univ. (Ontario).
J. W. B. Guise, and J. C. Flinn.
Australian and New Zealand Association For The Advancement of Science, 41st Congress - Adelaide, Aug 1969. 26 p, 4 tab, 23 ref.

Descriptors: *Model studies, *Simulation analysis, *Cost-benefit analysis, *Irrigation water, Spatial distribution, Temperal distribution, Water policy, Hydroelectric plants, Dams.
Identifiers: South Wales.

Spatio-temporal quadratic programming models, which provide a means of analysing water pricing and allocation decisions in existing water resource developments, were developed and applied using irrigation water demand data derived for the Yanco Irrigation Area in New South Wales. Alternative finite horizon deterministic models, having differing objective functions, were developed for a situation involving a single dam, with competing demands for water from several irrigation areas and a hydro-electric generating plant. A Net Social Payoff type competitive model was used and a set of demand relationships for irrigation water was specified, together with a set of marginal cost relationships relating to the supply of irrigation water. A monopolistic model for irrigation water allocation was derived also. The application of these models presented involved some abstraction from the existing situation in the Murrumbidgee Irrigation Area since water supplies are augmented from the Snowy Mountains Hydro Electric complex. Ex-

tension of the models to cover multiple dam river basins and additional water uses seemed conceptually straight forward but limitations should be recognized. Has 23 references. (Kriss-Cornell)
W71-03072

A STUDY OF WASTEWATER IRRIGATION THROUGH COMPUTER SIMULATION,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W71-03126

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MOVEMENT OF SALTS IN PONDED ANISOTROPIC SOILS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02G.
W71-02757

USE OF RUNOFF FORECASTING IN RESERVOIR OPERATIONS,
Salt River Project, Phoenix, Ariz.
Thomas T. Wilson, Jr., and Edib Kirdar.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR3, Paper 7541, p 299-308, September 1970. 10 p, 3 fig, 1 tab, 9 ref.

Descriptors: *Reservoir operation, *Runoff forecasting, *Arizona, Electric power, Irrigation water, Municipal water, Industrial water, Water supply, River forecasting, Data collections, Regression analysis, Water management (Applied).
Identifiers: Salt River Reservoir System (Ariz).

The application of runoff forecasting to the operation of the Salt River Project (Arizona) reservoir system has been studied since the late 1930's. The system consists of six dams with a total impoundment capacity of more than 2,000,000 acre-ft. The system provides power production as well as water for irrigation, municipal, and industrial use. During 1967, updated and improved forecast equations were produced from 18 yr of hydrologic records using multiple regression analysis. Forecasts made with these equations were utilized during the runoff seasons of 1967-1968 and 1968-1969. They provided valuable decision data for spill release in 1968 and for allocation of additional water to the users in 1969. (Knapp-USGS)
W71-02758

SPECIAL FLOOD PLAIN INFORMATION STUDY, LUXAPALILA CREEK - TOMBIGBEE RIVER AND TRIBUTARIES, MISSISSIPPI AND ALABAMA.
Corps of Engineers, Mobile, Ala.

Corps of Engineers Flood Plain Report, October 1970. 6 p, 14 plate, 1 tab.

Descriptors: *Flood plains, *Flood routing, *Planning, *Floodways, *Flood control, Potential flow, Flood damage, Mississippi, Alabama, Discharge measurement, Zoning, Watershed management.
Identifiers: Luxapalila Creek (Miss), Flood plain management, 100-year flood.

To provide officials of Columbus and Lowndes County, Mississippi, information about potential flooding along Luxapalila Creek for a flood plain management program, particularly in the lower 20 mi part of the basin, extensive topographic surveys were made and hydrologic data compiled on which this report is based. This creek, drainage area 513,000 acres, rises in Marion County, Alabama and flows southwesterly 75 mi through Fayette and Lamar Counties, Alabama and Lowndes County, Mississippi, to join the Tombigbee River at Columbus. Average fall is 3 1/2 ft per mi. This report presents a history of past flooding and possible future floods, flood plain maps, flood profiles, stage and discharge hydrographs, and other technical data. It is concluded that to realize full benefits offered by the proposed improvement of Luxapalila Creek, floodway regulations incorporating the 100-yr design presented in this report should be adopted by local officials. (Lang-USGS)
W71-02763

FLOOD PLAIN INFORMATION OF LOWER RIVER ROUGE, WAYNE MICHIGAN AND VICINITY.
Corps of Engineers, Detroit, Mich.

Corps of Engineers Flood Plain Report, 1970. 39 p, 3 fig, 9 plate, 12 tab.

Descriptors: *Floods, *Flood damage, *Michigan, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Washtenaw and Wayne Counties9mich), Standard project flood, Intermediate regional flood.

A study in Michigan along the Lower River Rouge flood plain from Merriman Road (mile 8.71) through the city of Wayne to Lotz Road (mile 15.52), Canton township, servicing 72 square miles extending over eastern Washtenaw and western Wayne Counties is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. Duration of floods is relatively short in the vicinity of Wayne. Stages can rise from stream bed to extreme flood peaks in less than 12 hours following intense rainfall. (Woodard-USGS)
W71-02764

FLOOD PLAIN INFORMATION - LEMON CREEK AT JUNEAU, ALASKA.
Corps of Engineers, Juneau, Alaska.

Corps of Engineers Flood Plain Report, June 1970. 22 p, 4 fig, 11 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Alaska, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Juneau (Alas) area, Standard project flood, Intermediate regional flood.

Flooding along Lemon Creek in the vicinity of Juneau, Alaska is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. The Intermediate Regional Flood for Lemon Creek would have a water surface elevation of 33 feet at the Glacier Highway Bridge. Standard project flood determinations indicate that flooding, under a combination of most severe conditions, would occur in the Lemon Creek area at an average depth of 2.6 feet higher than the Intermediate Regional Flood. (Woodard-USGS)
W71-02765

ESTIMATING THE FREQUENCY DISTRIBUTION OF HYDROLOGIC RESIDENCE TIMES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
T. G. Chapman.
In: Symposium on World Water Balance, Vol 1, I
nternational Association of Scientific Hydrolo
Publication No 92, p 136-152, July 1970. 17 p,
fig, 2 tab, 4 ref.

Descriptors: *Hydrologic budget, *Water storag
*Frequency analysis, Computer programs, Flo
Open channel flow, Porous media, Streamflo
Groundwater movement, Bank storage, Wat
balance, Mathematical models, Mixing, Dischar
(Water).
Identifiers: Hydrologic residence time.

The frequency distribution of residence times in
hydrologic storage depends on the input regin
and the hydraulics of flow through the storag
Estimates of this frequency distribution are usef
for planning of efficient data collection and math
matical model developments in studies of wat
balances at all scales. Estimates of limiting valu
for the frequency distribution of residence tim
can be made on the basis of three assumptio
about flow through storage: (1) first in first out, r
mixing; (2) last in first out, no mixing; and (3) i
stantaneous complete mixing. It is usually possib
to assess which of these assumptions is mo
realistic or at least to postulate that the real situ
tion is intermediate between two of the assum
tions. A computer program was written to dete
mine the frequency distribution of residence time
on the basis of these assumptions, from a give
sequence of inputs and outputs and the initi
storage volume. Examples of results are given for
surface reservoir, soil moisture in different climat
regimes, a groundwater system, and synthetic inp
data for a hypothetical storage with constant ou
put. (Knapp-USGS)
W71-02770

FORECASTING OF DRY WEATHER STREAM FLOW,
Baghdad Univ., (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 02E.
W71-02780

WATER INFLOW COMPUTATION OF TH PLANNED ANKARA CERKESHOYUK RESEI VOIR,
Topraksu Central Research Inst., Ankara (Tu
key).
Irfan Soykan.
In: Proceedings of Central Treaty Organizatio
Seminar on Evaluation of Water Resources Wit
Scarce Data, March 4-8, 1969, Tehran, Iran, p 41
420, January 1970. 8 p, 1 tab.

Descriptors: *Reservoir design, *Water resource
*Reservoir storage, *Water yield, *Foreign pr
jects, Planning, Model studies, Hydrologic dat
Precipitation (Atmospheric), Evapotranspiratio
Temperature, Climates, Equations.
Identifiers: *Turkey, *Scarce data, Water inflow
Annual runoff computations.

Principles involved in computing water inflow t
farm ponds or reservoirs below ungaged sma
watersheds are followed in predicting water yiel
for the planned reservoir project on Karaagiz
Creek watershed 40 kilometers southwest of An
kara, Turkey with a drainage area of 21.1 sq km
Results of the different methods applied indicat
that the reservoir design should be based on actua
flow measurements since the estimated values sho
great variations. (Woodard-USGS)
W71-02804

KHUZESTAN WATER RESOURCES AP PRAISAL,
Khuzestan Water and Power Authority, Tehra
(Iran).
Manouchehr Alavi.
In: Proceedings of Central Treaty Organizatio
Seminar on Evaluation of Water Resources Wit
Scarce Data, March 4-8, 1969, Tehran, Iran, p 353
381, January 1970. 29 p, 12 plate, 7 tab, 9 ref.

escriptors: *Water resources, *Water resources evelopment, *Water management (Applied), Irgation, Hydroelectric power, Navigation, Rivers, ams, Flood control, Streamflow, Runoff, Rainfall atersheds (Basins), Hydrologic data, Gaging staons, Discharge measurement, Equations, Design ow, Foreign projects, Dam design.
entifiers: *Iran.

ccomplishments since 1956 and future plans in eveloping surface water resources in the huzestan region of southwest Iran are reviewed. he area covers almost one-eleventh of Iran's 600,000 kilometers area and is the home of early one-eighth of the country's 25 million popution. Within the region are three large cities. Ahaz, the oil refining center of Abadan, and the Port Khorramshahr. Of major important natural sources of Khuzestan are five rivers not touched divided by international boundaries, the Karun, ez, Karkheh, Jarrahi and the Hendijan, flowing om the Zagros and Bakhtiari mountains uthward through the Khuzestan Plain to the Perian Gulf. The amount of water carried annually by ese five rivers has been estimated as 35 billion ubic meters. The first engineering reconnaissance nd appraisal of the area suggested building 14 rge scale multiple-purpose storage dams to conol the five major rivers and to replace their estructive flood damages with irrigation, power nd navigation benefits. The schemes will ultimate- provide sufficient regulated flow to irrigate alost one million hectares of Khuzestan arable nds and will also be capable of producing more an 6 million killowatts of low-cost hydroelectrici- and achieve a high degree of flood control in the nds of the plain. Methods are described for utiliz- g gaging-station records in expressing formulas nd data needed to evaluate and design wateresources projects. Results are given in tables, ydrographs, and maps. (Woodard-USGS)
/71-02808

PILLWAY DESIGN FLOOD FOR DAMS IN RAN,
an Plan Organization, Tehran.
arviz Hekmat.
: Proceedings of Central Treaty Organization eminar on Evaluation of Water Resources With carce Data, March 4-8, 1969, Tehran, Iran, p 341-51, January 1970. 11 p, 1 fig, 1 tab.

escriptors: *Spillways, *Design flow, *Design orm, Flow control, Dams, Floods, Streamflow, unoff, Peak discharge, Flow rates, Water manageent (Applied), Watersheds (Basins), Hydrologic ata, Discharge measurement, Gaging stations, oreign projects.
dentifiers: *Iran, Flood runoff, Spillway design.

esign storms and flood runoffs are used for reparing flood and drainage area relationship urves which are important in the design of dams. he general pattern of rainfall distribution in Iran, xcept in the Caspian Sea Basin, is a wet season in inter and spring and dry the remainder of the ear. The flood season is usually from late winter to id-spring. River gaging measurement dates back the year 1945 when a few gaging stations were stablished on the rivers in the Tehran vicinity. lowever, today there are about 150 gaging stations n various rivers of Iran. All the records are of relavely short duration, except that of Karun. The acuracy of stream flow records is somewhat uestionable, especially for peak discharges of the arly years of river gaging. The remoteness of gage ocations, poor conditions of access roads, insuffiient technical personnel and shortage of equipent are the main causes of relatively poor, but imroving data. Considering all of the above points, ischarges of 100 rivers of Iran with five or more ears of record, were selected. (Woodard-USGS)
W71-02809

RESERVOIR CAPACITY AND OPERATION AS SET BY HYDROLOGICAL AND DRAW-OFF CONDITIONS,
Water Research Association, Marlow (England). Hydrology Div.
J. A. Cole.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 195-222, January 1970. 27 p, 11 fig, 3 tab, 28 ref.

Descriptors: *Water resources, *Reservoirs, *Model studies, Watershed management, Reservoir storage, Reservoir evaporation, Reservoir leakage, Reservoir silting, Reservoir design, Reservoir construction, Reservoir yield, Overflow, Equations.
Identifiers: *Scarce data, *Spillage, Flow frequencies, Long-term mean, Standard deviation.

Factors that increase and reduce the water supplies in reservoirs are examined under the following headings: (1) How a reservoir acts; (2) Simulation on the action of a reservoir under chosen draw-off rules; (3) Long-term yield from storage; (4) Seasonal storage calculation; and (5) Varying draw-off to meet current conditions of surplus or shortage. Tables, equations, and graphs relate data to reservoir hydrology. Simulation methods are preferable when there are many alternatives possible for operation of reservoirs because under such conditions statistical methods tend to give misleading results. Great care is needed in applying Langbein's curves in the Middle East, especially where the runoff is approximately 5% of the mean annual rainfall. (Woodard-USGS)
W71-02817

SOME CHARACTERISTICS OF THE OPERATIONAL RESERVOIRS IN THE ISRAEL NATIONAL WATER SYSTEM,
For primary bibliographic entry see Field 02H.
W71-02871

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02J.
W71-02874

AN ASSESSMENT OF OPTIMIZATION TECHNIQUES AS APPLIED TO WATER RESOURCE SYSTEMS,
Environmental Dynamics, Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W71-02878

EFFECTS OF STREAM STRAIGHTENING ON FLOOD RUNOFF CHARACTERISTICS,
Iowa State Water Resources Research Inst., Ames.
Kenneth L. Campbell, and Howard P. Johnson.
Available from NTIS as PB-196 358, $3.00 in paper copy, $0.95 in microfiche. M.S. Thesis. Iowa State University Water Resources Research Institute Completion Report, October 15, 1970. 132 p, 66 fig, 9 tab, 52 ref. OWRR Project No B-005-IA (4).

Descriptors: *River training, *Water control, *Drainage effects, *Mathematical model, Drainage districts, Iowa, Controlled drainage, Improvement, Levees, Watershed management, Peak discharge, Flood protection, Economic justification.
Identifiers: *Stream modification effects, Flood runoff characteristics, Watershed hydraulics, Boyer River (Iowa).

The effects of much stream straightening and diking on physical flow characteristics were determined on Boyer River in western Iowa. Problems are present in the several drainage districts concerning distribution of cost assessments for construction, repairs, and maintenance along the river. Precipitation and runoff data are tabulated for historic storms. The kinematic flood routing method was used with a computer to obtain discharge hydrographs at several places for two different volumes of river flow. Several flow variations and two flood routing time increments were used for stream conditions before and after the straightening and diking. Values of several physical flow used as indicators of the effects of stream straightening and diking. Flow characteristics used were: (1) peak discharge, (2) time to peak, (3) flood wave travel time, and (4) duration of flooding. Major conclusions are: (1) peak discharge after straightening was increased significantly, (2) flooding was eliminated by the improvements, and (3) flood wave travel time was reduced greatly by straightening the river channel. (Lang-USGS)
W71-02881

WATER RESOURCES AND REGIONAL LAND-USE PLAN,
Harza Engineering Co., Chicago, Ill., Water Resources Planning Div.
For primary bibliographic entry see Field 06B.
W71-02903

FORECASTING WATER DEMANDS AND SYSTEMS CAPABILITIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 06D.
W71-02905

HYDROLOGY OF SURFACE WATER IN IRAN,
Ministry of Water and Power, Tehran (Iran). Dept. of Hydrology.
For primary bibliographic entry see Field 07A.
W71-02912

COUNTRY REPORT FOR TURKEY,
Water Operations and Hydrology Lab., Ankara (Turkey).
For primary bibliographic entry see Field 07C.
W71-02914

WATER RESOURCES DEVELOPMENT IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
Aolad Hosain.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 37-56, January 1970. 20 p, 3 fig, 1 tab.

Descriptors: *Water resources, *Water resources development, *Surface waters, *Programs, Planning, Flood plains, Flood control, Drainage, Irrigation, Navigation, Hydroelectric power, Watershed management, Cyclones, Groundwater basins, Foreign projects, Hydrologic data.
Identifiers: *East Pakistan, Scarce data.

Since its independence in 1947, East Pakistan has executed 51 hydrological projects concerning flood control, drainage, irrigation, navigation, and hydroelectric power. Results and future objectives of the projects are discussed relative to the development of water resources in the country. Consisting mostly of a delta formed by the Ganges, Brahmaputra and Meghna Rivers and their tributaries, the Province has an area of 55,126 sq mi (one-seventh of all Pakistan). The population was more than 50 million in 1961. A long range Master Plan prepared by the General Consultant of East Pakistan (WAPDA) gives a framework for water resources development as a major part of an improvement program involving all facets of the entire economy. The projects under way are scheduled to match increased growth requirements until 1985. Methods of water development are described, particularly flood protection, drainage and irrigation. Due to the flat terrane and lack of reservoir sites, simple embankments along the streams to confine floods is the most practical solution to periodic flooding of 8 million acres. Water

for irrigation can be obtained from gravity diversions and pumping from streams and by pumping from wells. Cyclones and sea water intrusion are problems that complicate development and management of the water resources. (Lang-USGS)
W71-02915

COUNTRY REPORT FOR PAKISTAN,
Irrigation, Drainage and Flood Control Research Council, Rawalpindi (Pakistan).
For primary bibliographic entry see Field 06B.
W71-02916

COUNTRY REPORT FOR UNITED KINGDOM,
Water Resources Board, Reading (England).
For primary bibliographic entry see Field 06B.
W71-02917

PREPARATION OF LONG TERM FLOW SEQUENCE FROM SHORT TERM RECORD BY STATISTICAL MEANS,
Ministry of Water and Power, Tehran (Iran).
For primary bibliographic entry see Field 02E.
W71-02920

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 9. COLORADO RIVER BASIN - VOLUME 2.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W71-02924

EVALUATION OF THE STREAMFLOW-DATA PROGRAM IN OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 07A.
W71-02925

MISCELLANEOUS STREAMFLOW MEASUREMENTS IN IDAHO, 1894-1967,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 07C.
W71-02927

FLOOD PLAIN INFORMATION OF BIG WOOD RIVER, KETCHUM, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.

Corps of Engineers Flood Plain Report, June 1970. 30 p, 7 fig, 21 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Idaho, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Ketchum (Ida), Standard project flood, Intermediate regional flood.

The flood situation along Big Wood River above Eagle Creek to below the East Fork, a total of 13.4 miles of the stream is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. Largest past floods for which records are available were the floods of 1938, 1956, 1958, 1965, 1967, and 1969. Damaging floods are known to have occurred in 1887 and 1894. From records for 55 years to date, some 15 floods have had peak discharges significantly above bankfull in the stream. (Woodard-USGS)
W71-02928

DETERMINATION OF PROBABILITY DISTRIBUTION OF MAXIMUM DISCHARGES ON THE BASINS OF ALL OBSERVED FLOODS,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 02E.
W71-02929

IMPROVED PRECISION OF FUTURE HIGH FLOODS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 02E.
W71-02930

PRINCIPLES FOR ELABORATION OF MATHEMATICAL RUNOFF MODELS,
Moscow State Univ., Moscow (USSR).
For primary bibliographic entry see Field 02E.
W71-02931

A NUMERICAL MODEL OF THE RUNOFF PROCESS OF MOUNTAIN RIVERS,
For primary bibliographic entry see Field 02E.
W71-02932

AN ESTIMATE OF DISCHARGE PROBABILITIES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02E.
W71-02933

THE ESTIMATION OF EXTREME PRECIPITATION AS THE BASIS FOR DESIGN FLOODS - RESUME OF PRACTICE IN THE UNITED STATES,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
For primary bibliographic entry see Field 02E.
W71-02934

APPLICATION OF THE METHOD OF MAXIMUM RUNOFF COMPUTATION USING THE PRECIPITATION REDUCTION CURVES IN THE MARITSA RIVER BASIN,
Bulgarian Academy of Sciences, Sofia. Inst. of Hydrology and Meteorology.
For primary bibliographic entry see Field 02E.
W71-02937

ON THE EXPEDIENCY OF USING COMBINED SERIES OF HYDROLOGICAL CHARACTERISTICS FOR FLOOD COMPUTATION,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02938

ESTIMATING THE ACCURACY OF STATISTICAL FLOOD VALUES BY MEANS OF LONG-TERM DISCHARGE RECORDS AND HISTORICAL DATA,
For primary bibliographic entry see Field 02E.
W71-02939

ASSESSMENT OF A DESIGN DISCHARGE OF A RIVER,
For primary bibliographic entry see Field 02E.
W71-02940

ESTIMATION OF FLOOD FLOWS USING MATHEMATICAL STATISTICS,
Energoprojekt, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02E.
W71-02941

SPATIAL AND TEMPORAL ANALYSIS OF MAXIMUM RUN-OFF,
Moscow State Univ., Moscow (USSR).
For primary bibliographic entry see Field 02E.
W71-02942

ON A GENERAL THEORY OF DURATION CURVE AND ITS APPLICATION TO EVALUATE THE PLOTTING POSITION OF MAXIMUM PROBABLE PRECIPITATION OR DISCHARGE,
India Meteorological Dept., New Delhi.
For primary bibliographic entry see Field 02E.
W71-02943

INCREASING THE ACCURACY OF DETE MINATION OF MAXIMUM DISCHARGES AN THEIR EXCEEDENCE PROBABILITY,
For primary bibliographic entry see Field 02E.
W71-02947

EXTRAPOLATION OF DISCHARGE RATIN CURVES USING CHEZY'S FORMULA,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02948

IMPACT-TYPE ENERGY DISSIPATOR FO STORM-DRAINAGE OUTFALLS STILLIN WELL DESIGN.
Army Engineer Waterways Experiment Statio Vicksburg, Miss.

Technical Report No 2-620, March 1963. 66 p, tab, 37 plates.
Identifiers: *Storms, Drainage, *Undergrou structures, Design, *Erosion, Control, Pip Plastics, Energy, Impact, Fluid flow, Piezoelect gages, *Stilling wells, *Energy dissipators.

An impact-type energy dissipator consisting of vertical section of circular pipe affixed to the outl end of a storm drainage outfall, termed a stilli well, was studied in the laboratory to determine t energy loss coefficient and the effects of t geometrical components of such a structure. T results were generalized and given in terms dimensionless parameters. Investigations were co ducted with a 0.99-ft-diameter model stilling w which had a 2-ft-diameter collar attached to the t to simulate a broad-crested circular weir, and i coming pipes with diameters of 0.33, 0.40, a 0.60 ft on slopes of 1 on 1, 1 on 2.2, and 1 on There is an optimum depth of the stilling w below the invert of the incoming pipe, depende on the slope of the incoming pipe. Limited tests i dicated that there is also an optimum height of t well above the pipe invert for each given set of co ditions. In regard to energy dissipation, test resu show that the smaller the ratio of the diameter the incoming pipe to that of the stilling well and t flatter the slope of the incoming pipe, the great the value of the energy loss coefficient. The ener loss coefficient is less for full pipe flow than for pa tial pipe flow. Discharge coefficients for a circul stilling well were determined for both partial a full pipe inflows and free outflow conditions, a empirical equations were developed.
W71-02954

GUIDE TO IMPROVEMENT OF ARIZON RANGELAND.
Arizona Agricultural Experiment Station, Tucson
For primary bibliographic entry see Field 03F.
W71-02965

COST-BENEFIT ANALYSIS FOR INLAN NAVIGATION IMPROVEMENTS,
Northwestern Univ., Chicago, Ill. Econometri Center.
For primary bibliographic entry see Field 06B.
W71-02981

BOARD OF HUDSON RIVER REGULATIN DIST V FONDA, J AND G RR (TAKING O PROPERTY TO REGULATE RIVER FLO FOR PUBLIC BENEFIT).
For primary bibliographic entry see Field 06E.
W71-03026

BAY RIDGE DOCK CO V UNITED DR DOCKS, INC (GRANTEE OF BOTTOMLAN MAY FILL IN TO BULKHEAD LINE).
For primary bibliographic entry see Field 06E.
W71-03030

NITED STATES V WEST VIRGINIA (POWER F THE UNITED STATES TO PREVENT CONTRUCTION OF DAMS ON NAVIGABLE IVERS).
or primary bibliographic entry see Field 06E.
'71-03041

IME SEQUENCING OF ELEMENT CONTRUCTION IN A MULTI-RESERVOIR YSTEM,
ater Resources Engineers, Inc., Springfield, Va.
or primary bibliographic entry see Field 06A.
'71-03069

UNOFF AND EROSION CONTROL BY EEDED AND NATIVE VEGETATION ON A OREST BURN: BLACK HILLS, SOUTH AKOTA,
orest Service, Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
oward K. Orr.
SDA Forest Service Research Paper RM-60, September 1970. 12 p, 7 fig, 3 tab, 5 ref.

escriptors: *Erosion control, *Overland flow, Forest fires, *Vegetation regrowth, *Land anagement, *South Dakota, Cover crops, ecipitation (Atmospheric), Forest management, unoff, Erosion, Streamflow, Flow rates, Sediment ansport, Vegetation establishment, Vegetation effcts, Reforestation, Plants, Soil stabilization.
entifiers: *Black Hills (S Dak).

rowth of seeded species in combination with establishment of native vegetation reduced overnd runoff and soil erosion to tolerable levels thin one to four growing seasons. Gross rainfall as a poor indicator of runoff and soil erosion from nall plots. Trends were best defined by declining tes of runoff and sediment production per unit of cess rainfall. Sixty percent ground-cover density ive vegetation plus litter) is postulated as the inimum necessary for soil stabilization. This ver density almost certainly could not have been ached within the 4-year study period without eding. Seeded grasses--timothy and Kentucky uegrass on coarse-textured soil and timothy and nooth brome on fine-textured soil--were espeally important because of their dispersion and undance, and persistence of litter production. Woodard-USGS)
'71-03131

LOOD PLAIN INFORMATION, MENENHALL RIVER, JUNEAU, ALASKA.
orps of Engineers. Alaska District.

orps of Engineers Flood Plain Report, June 1970. 3 p, 7 fig, 12 plate, 3 tab.

escriptors: *Floods, *Flood damage, *Flood ains, *Alaska, Historic flood, Flood forecasting, egional flood, Design flood, Glaciers, Land use, nowmelt.
lentifiers: *Mendenhall River, Juneau (Alaska), ntermediate regional floods, Standard project ood.

record is given of the largest known floods along lendenhall River, a glacier-fed stream which rains a 103 sq mi area ranging in elevation from a level to 7,000 ft. The floodplain area is 8 mi orthwest of Juneau. Forecasts are made of probale future floods of Intermediate Regional size average of once in 100 yr) and Standard Project loods (largest expected to occur) for planning the est utilization of flood-prone lands. The greatest nown flood occurred in Sept. 1927, but caused nall damage because of little utilization of the oodplain. Now because of large industrial evelopment underway and planned and need for nd for the expanding economy of the Juneau area nd use must be controlled to avoid flood damage. ccurate records of stage and flow rates were arted in 1965 with installation of USGS gaging ations on the stream. Scarce data indicate that rge floods caused by intense rainfall can occur any time during summer or early fall, but a period of high water also occurs every spring caused by snow melt. Channel flow velocities during major floods range up to 17 ft per sec; the velocities on the floodplain vary, usually at rates less than 3 ft per sec. Major floods would be out of banks for about 4 days. (Lang-USGS)
W71-03134

DAMS AND SPILLWAYS (PROCEDURES FOR INITIATING CONSTRUCTION OR ALTERATION).
For primary bibliographic entry see Field 06E.
W71-03227

NATHANSON V WAGNER (ALTERED FLOW OF SURFACE RUNOFF ALLEGED TO HAVE DAMAGED DOWNHILL LANDOWNER).
For primary bibliographic entry see Field 06E.
W71-03231

DYKSTRA V DARLING (DRAINAGE RIGHTS OF ADJACENT PROPERTY OWNERS).
For primary bibliographic entry see Field 06E.
W71-03232

CITIZEN'S HARDWARE AND FURNITURE CO V CHICAGO, ROCK ISLAND AND PACIFIC RY (PROXIMATE CAUSE OF FLOODING MUST BE PROVEN BY PLAINTIFF).
For primary bibliographic entry see Field 06E.
W71-03235

DUCK ISLAND HUNTING AND FISHING CLUB V EDWARD GILLEN DOCK, DREDGE AND CONST CO (FEDERAL AND STATE APPROVAL OF RIVER PROJECTS AS PREREQUISITE TO A VALID CONTRACT).
For primary bibliographic entry see Field 06E.
W71-03239

CHICAGO, ST L AND N O RR V BULLOCK (LIABILITY FOR FLOOD DAMAGE CAUSED BY OVERFLOW OF DRAINAGE DITCH OBSTRUCTED BY RAILROAD EMBANKMENT).
For primary bibliographic entry see Field 06E.
W71-03240

BECK V STATE EX REL ATTNY GEN (RIPARIAN RIGHT TO DRAIN LAKE TO MAINTAIN NATURAL WATER LEVEL).
For primary bibliographic entry see Field 06E.
W71-03242

REED V CULLOR (LIABILITY FOR CROP DAMAGE CAUSED BY OBSTRUCTION OF NATURAL STREAM FLOW).
For primary bibliographic entry see Field 06E.
W71-03243

HENICLE V PENNSYLVANIA RR (REPULSION OF SURFACE WATER BY RAILROAD).
For primary bibliographic entry see Field 06E.
W71-03244

DRAINAGE DISTRICTS (ANNEXATION, REPAIR, CONSTRUCTION, IMPROVEMENT: COUNTY COURT JURISDICTION).
For primary bibliographic entry see Field 06E.
W71-03264

TUCKER V HAGAN (LIABILITY FOR DISCHARGE OF SURFACE RUNOFF UNTO SERVIENT ESTATE).
For primary bibliographic entry see Field 06E.
W71-03265

MCWHORTER V CITY OF CLARKSBURG (PRESCRIPTIVE RIGHT TO OVERFLOW LAND AS A DEFENSE).
For primary bibliographic entry see Field 06E.
W71-03268

KITCHEN LUMBER CO V TALLASSEE POWER CO (WASHOUT OF RAILROAD BRIDGE CAUSED BY NEGLIGENT OPENING OF DAM FLOODGATES).

206 NC 515, 174 SE 427-431 (1934).

Descriptors: *North Carolina, *Dams, *Bridges, *Flooding, Lumbering, Access routes, Railroads, Concrete dams, Backwater, Floodgates, Overflow, Rivers, Washouts, Damages, Compensation, Profit, Adjudication procedure, Judicial decisions, Legal aspects, Rainfall, Rain, Rainfall-runoff relationships, Remedies.

Plaintiff lumber company sued defendant damowner for damages caused by the opening of defendant's dam. Plaintiff owned a railroad bridge downriver from the dam, and following a heavy rainfall defendant opened the dam gates, allowing a tremendous amount of water to rush downriver and wash out plaintiff's bridge. Plaintiff sought damages from the bridge destruction and recovery of lost profits because of an inability to market its lumber. The trial court had refused to admit defendant's evidence that plaintiff had not mitigated damages. On this appeal, defendant asserted that there was insufficient evidence to support the jury finding that the bridge was negligently destroyed and that the trial court erred by refusing to admit the evidence on mitigation. The appellate court stated that where an owner interferes with the natural course of a stream, he is strictly liable for proximate injury unless it was caused by an uncontrollable intervening force. Reviewing the evidence, the court held that it was sufficient to support the jury's finding. However, finding error in refusal to admit evidence on mitigation, the court directed a new trial on the issue of lost profits. (Hart-Florida)
W71-03269

NECHES CANAL CO V MILLER AND VIDOR LUMBER CO (LOSS OF PROFITS FROM UNLAWFUL DAM ERECTION).
For primary bibliographic entry see Field 06E.
W71-03270

BARR V SPALDING (UNITED STATES' LIABILITY FOR RAISING RIVER ABOVE HIGH WATER MARK).
For primary bibliographic entry see Field 06E.
W71-03272

FLAMBEAU RIVER LUMBER CO V LAKE SUPERIOR DIST POWER CO (OBSTRUCTION OF NAVIGABLE STREAM BY IMPROPER DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-03275

MORTON V CHESAPEAKE AND O RY (ALTERATION OF STREAM'S COURSE AS PERMANENT OR TEMPORARY INJURY).
For primary bibliographic entry see Field 06E.
W71-03277

SINCLAIR REFINING CO V SMITH (LIABILITY FOR DECREASE IN CHANNEL DEPTH CAUSED BY NEGLIGENT DREDGING).
For primary bibliographic entry see Field 06E.
W71-03283

NORFOLK AND W RY V MCCOY (RAILROAD'S FILL DIVERTS RIVER, ERODING FARMLAND).
For primary bibliographic entry see Field 06E.
W71-03286

LAMB KNITTING MACH CO V CHICOPEE MFG CO (LITIGATION OVER AGREEMENT TO FURNISH WATER POWER).
For primary bibliographic entry see Field 06E.
W71-03287

IN RE VILLAGE OF LYNBROOK (VALUE OF LAND CONDEMNED FOR DRAINAGE EASEMENT WHERE OTHER EASEMENTS ALREADY EXIST).
For primary bibliographic entry see Field 06E.
W71-03292

STATE DISPOSITION OF SUBMERGED LANDS VERSUS PUBLIC RIGHTS IN NAVIGABLE WATERS,
For primary bibliographic entry see Field 06E.
W71-03296

4B. Groundwater Management

INVESTIGATION OF GROUND-WATER RESOURCES IN THE DASHT-MOGHAN AREA, AZARBIJAN, IRAN,
Tehran Regional Water Authority (Iran).
For primary bibliographic entry see Field 02F.
W71-02806

SUBSIDENCE AND GROUNDWATER OFF-TAKE IN THE BATON ROUGE AREA,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 02F.
W71-02828

PROGRESS REPORT ON GROUNDWATER INVESTIGATION IN IRAN,
Ministry of Water and Power, Tehran (Iran). Div. of Groundwater.
For primary bibliographic entry see Field 02F.
W71-02913

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS, 1965-70,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 07C.
W71-02921

THE TWICE-USED WATER,
For primary bibliographic entry see Field 02F.
W71-02959

ARIZONA AGRICULTURE 1970.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02960

WATER USE BY IRRIGATED SUGAR BEETS IN THE TEXAS HIGH PLAINS,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 02G.
W71-02963

ARIZONA AGRICULTURE 1969.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02967

DEVELOPMENT AND FIELD TESTING OF LARGE VOLUME REMEDIAL TREATMENTS FOR GROSS WATER CHANNELING,
Pan American Petroleum Corp., Tulsa, Okla.
L. R. Smith, C. R. Fast, and O. R. Wagner.
Journal of Petroleum Technology, Vol 21, No 8, p 1015-1025, August 1969. 5 tab, 11 fig, 12 ref.

Descriptors: *Oil wells, *Water wells, Drilling fluids, Mud, Water flood, *Injection wells.
Identifiers: *Water channeling, *High flow capacity zones, Acidic silica gels, Alkaline silica gels, Sweep efficiency, Laboratory tests, Field tests, Low-cost bentonite-nutshell slurries.

This paper describes laboratory development and field testing of plugging agents for large volume treatments of waterflood channeling problems which arise from fluids passing through interwell fractures or high permeability strata. To improve sweep efficiency in reservoirs where water bypassing occurs through interwell fractures, large volume of slurries may be injected at pressures above the fracture opening level to pack the fracture with settled solids and shut off flow. Low-cost benfonite-nutshell slurries were developed and proved effective in field testing for improving sweep efficiency. To improve sweep efficiency in reservoirs where water channeling occurs through high permeability zones or where water is lost from desired injection intervals through localized fractures, long-set-time alkaline silica gels may be injected to plug the by-pass zones. Effective treatments using only a few thousand barrels of these gels are possible. Field testing demonstrated that the alkaline silica gels are effective in reducing flow through by-pass zones. (Campbell-NWWA)
W71-02982

SAMPLE CATCHER YIELDS CLEAN CUTTINGS, RETAINS FINES,
Petrocraft Products Ltd., Calgary (Alberta).
R. B. Morris.
World Oil, Vol 166, No 6, p 97-98, May 1968. 3 fig, 1 ref.

Descriptors: *Sampling, Data collections, *Drilling, Homogeneity, *On-site data collections, Reliability, Logging (Recording), Petrography, Drill holes.
Identifiers: *Retention of fines, Well-site lithologic logging.

Simple machine has been developed that provides selected, screened and washed subsurface rock cuttings. It consists of an outer cylinder, top plate and inner cylinder; apparatus is attached to mud tank in front of shale shaker or collector. It is activated by shaker and contains agitated water supply. Since human error is minimized from collecting process, superior well samples can be obtained. The machine's operation, advantages and limitations are discussed. Primary design features are: (1) catch, sieve, wash and collect aggregate or representative well cuttings in predetermined quantities, (2) provide a thorough but gentle washing action, (3) retain fines even when drilling carbonate, and (4) exclude most cavings. (Campbell-NWWA)
W71-02987

WELL LOGGING IN GROUNDWATER HYDROLOGY,
Geological Survey, Denver, Colo.
W. Scott Keys.
Groundwater, Vol 6, No 1, p 10-18, January-February 1968. 8 fig, 12 ref.

Descriptors: *Drilling, *Groundwater, Hydrology, Borehole geophysics, Water wells, Oil industry, *Logging (Recording).
Identifiers: *Electrical logging, *Radioactive logging, Flowmeter, Caliper, Fluid resistivity, Gradient and differential temperature, Sonic velocity.

In 1966 more than 50 billion gallons of water was pumped daily from an estimated 10 to 15 million water wells in the United States, one-sixth of the national withdrawal of water. On the basis of past rates of increase, a much greater future use of groundwater is suggested. Annual investment in water wells is one-half to three-quarter billion dollars, not including pumps and plumbing. In 1964 approximately 436,000 new wells were drilled, less than 1 percent of these wells were logged by any geophysical means. The application of geophysica well logging to groundwater hydrology is compara ble to its use in petroleum exploration in th 1930's; however, equipment and interpretatio techniques developed in the oil industry are availa ble now for use in groundwater investigations Although most petroleum well logging technique may be utilized in hydrology, modifications i equipment and interpretation are necessar because of basic economic and environmental dif ferences between petroleum and groundwate evaluation. If logging is to be widely applied t groundwater exploration and evaluation the ex pense of equipment and services must be reduced This can be accomplished, because most wate wells are not as deep as oil wells and the tempera tures and pressures are lower. The U.S. Geologica Survey is conducting research on the application o borehole geophysics to groundwater hydrology (Campbell-NWWA)
W71-02988

NEW TEMPERATURE LOG PINPOINTS WATER LOSS IN INJECTION WELLS,
Mitchell and Associates, Houston, Tex.
E. A. Riley.
World Oil, Vol 164, No 1, p 69-72, January 1967. fig, 1 ref.

Descriptors: *Oil wells, *Water injection, Wast disposal, Water wells, Casing, Logging, Wate flood, *Injection wells.
Identifiers: *Temperature log, *Fractional tem perature anomalies, Downhole fluid movement Casing leaks, Lost circulation zone.

A new, extremely accurate differential temperatur survey technique has been used successfully t precisely locate a downhole water loss in a water flood injection well, which was previously unde tectable by any other means. The differential tem perature log accurately measures fractional tem perature anomalies associated with fluid move ments downhole. Besides being used to detect flui communication downhole in water injection wells the technique is applicable for finding tubing-cas ing leaks, gas communication, productive zones lost circulation zones, production profiles and gas oil-water contacts. The use is discussed of the dif ferential temperature survey as a diagnostic, injec tion profile tool. (Campbell-NWWA)
W71-02990

FACTORS AFFECTING CURRINGS REMOVAL DURING ROTARY DRILLING,
Shell Development Co., Houston, Tex.
E. A. Hopkin.
Journal Petroleum Technology, Vol 19, No 6, 807-814, June 1967. 6 tab, 8 fig, 10 ref.

Descriptors: *Rotary drilling, Sampling, Data col lections, Oil wells, *Wells, *Drilling fluids, Mud. Identifiers: Laboratory tests, Field tests, *Particle slip velocity, Laminar annular mud flow, Stuck dril pipe, Mud viscosity, Canada.

Laboratory tests and field experience in Canada in dicated the magnitude of some of the factors affect ing ability of drilling mud to clean the hole. A cor relation was observed between funnel viscosity an particle slip velocity. A relationship was observe between the Bingham yield value of the mud an the particle slip velocity. Laboratory tests indicate little change in slip velocity with funnel viscositie up to about 80 sec/qt or to yield values of about 1 lb/100 sq ft. The slip velocity of the particles stu dies varied from 160 ft/min with water to nearl zero for high mud viscosities. Increasing the muc density, creating laminar annular mud flow, o rotating the drill pipe may improve the carryin capacity of mud. Field tests indicated that, durin fast upper-hole drilling, the rate of cutting remova must be sufficient to maintain the concentration o cuttings in the annulus at less than 5 percent b volume to prevent balled-up drill collars and stuc drill pipe. (Campbell-NWWA)
W71-02991

UICKSAND AND WATER WELLS,
F. Patchick.
roundwater, Vol 4, No 2, p 32-46, April 1966. 1
b, 11 fig, 32 ref.

escriptors: *Water wells, *Quicksand, *Drilling, roundwater, Water supply, Wells, Well screens, oke's law.
entifiers: Cable-tool completion, Rotary comple-on, Quicksand aquifer, Development techniques, ncemented alluvium, Fluvioglacial sediments, custrine sediments.

uicksand is no myth, nor is it a rare phenomenon, her on the surface or in the subsurface. In water lls, a 'quick' or 'heaving' condition may com-only exist if a confined, permeable, loose silt, nd or gravel stratum is continuous to distant gher ground, and is subject to greater head of ter existing at higher elevations. Stoke's Law ex-ains why fine, rounded grains become 'quick'. uicksand drilling and completion problems with ble-tool and rotary wells and suggestions for ercoming them are discussed. (Campbell-WWA)
71-02993

HE DRILL-STEM TEST: THE PETROLEUM DUSTRY'S DEEP-WELL PUMPING TEST,
eological Survey, Washington, D.C. Water esources Div.
D. Bredehoeft.
roundwater, Vol 3, No 3, p 31-36, July 1965. 1 b, 6 fig, 8 ref.

escriptors: *Oil industry, *Oil wells, *Water lls, *Pressure head, *Permeability, *Water emistry, Hydraulics, Hydrologic data, Testing.
entifiers: *Drill-stem test, *Petroleum engineer-g, Formation fluid, Formation pressure, Forma-on coefficient of permeability.

rill-stem tests provide the petroleum industry in-rmation on three critical properties of subsurface rmations--pressure head, permeability, and water emistry--that the groundwater hydrologist also eks in making pumping tests of water wells. As it increasingly necessary to study the hydraulic and ochemical properties of deep-lying rocks in der to understand the behavior of groundwater, ta on drill-stem tests made by the petroleum in-stry become an important source of information hich othewise is unobtainable because of the high st. Data from these tests made by methods cur-ntly in use are highly useful in water studies. Both troleum engineering and groundwater hydrology nd to profit substantially from an increase in the terchange of ideas and techniques. (Campbell-WWA)
71-02994

YDROLOGY OF LIMESTONE TERRANES - NNOTATED BIBLIOGRAPHY OF CAR-ONATE ROCKS,
labama Geological Survey, University.
or primary bibliographic entry see Field 02F.
71-03109

NNOTATED BIBLIOGRAPHY ON ARTIFI-IAL RECHARGE OF GROUNDWATER, 1955-,
eological Survey, Washington, D.C.
. C. Signor, D. J. Growitz, and William Kam.
or sale by the Superintendent of Documents, US overnment Printing Office, Wash, DC, 20402 - rice $0.65. Geological Survey Water - Supply aper 1990, 1970. 141 p.

escriptors: *Bibliographies, *Artificial recharge, Abstracts, Water spreading, Injection wells, ater reuse, Infiltration, Groundwater movement, t recharge, Reclaimed water.
entifiers: *Artificial recharge bibliography.

his bibliography emphasizes the technology of roundwater recharge; however, annotations of ar-cles on waste water reclamation, groundwater management and groundwater basin management are included. Subjects closely related to artificial recharge, including colloidal flow through porous media, field or laboratory instrumentation, and waste disposal by deep well injection are included where they specifically relate to potential recharge problems. Artificial groundwater recharge is a means of conserving surface runoff for future use in places where it would otherwise be lost, of protecting groundwater basins from salt-water encroachment along coastal areas, and of storing and distributing imported water. The bibliography is arranged alphabetically by author. The indexing is by subject and geographic location. Each article was assigned the key words or phrases to best characterize its contents. (Knapp-USGS)
W71-03130

WATER RESOURCES AND RELATED GEOLOGY OF DERA ISMAIL KHAN DISTRICT, WEST PAKISTAN, WITH REFERENCE TO THE AVAILABILITY OF GROUNDWATER FOR DEVELOPMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W71-03132

WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
B. W. Gould.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 6, p 76-104, April 1970. 29 p, 42 ref.

Descriptors: *Water reuse, *Artificial recharge, *Reclaimed water, *Reviews, Hydrogeology, Waste water treatment, Water chemistry, Eutrophication, Urbanization, Water demand, Water yield, Water utilization, Water management (Applied), Water quality.
Identifiers: *Waste water reclamation.

The use of artificial recharge to reclaim waste water is reviewed. In some places where local fresh water supplies are limited, and water can be brought to the area only at considerable cost, waste water is being reclaimed for reuse. The use of waste water to recharge aquifers is a reclamation method which has a number of technical and aesthetic advantages, and has been the subject of laboratory, field, and full-scale investigations in America, Israel, and Holland. When waste water percolates through soil, natural physical, chemical, and microbiological processes not only can cause large reductions in the amount of putrescible organic material and in the number of bacteria, but also can remove suspended material and reduce the amount of nutrients which could cause eutrophic conditions. For injection wells, water should be treated to a fairly high degree of organic purity; but seepage basins operated on a suitable intermittent schedule under good conditions can produce potable groundwater even from sewage which has had only primary treatment. (Knapp-USGS)
W71-03136

SYSTEM MODELLING FOR CONJUNCTIVE USE OF A GROUNDWATER AQUIFER AND A SURFACE RESERVOIR,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
D. T. Howell, and P. R. Johnston.
In: Proceedings of Groundwater Symposium, New South Wales University, Manly Vale, Australia, August 28-29, 1969: New South Wales University Water Research Laboratory Report No 113, Paper No 10, p 152-160, April 1970. 9 p, 2 fig, 5 ref.

Descriptors: *Systems analysis, *Dynamic programming, *Water resources development, *Conjunctive use, Alluvium, Streamflow, Water storage, Reservoirs, Aquifers, Reservoir operation, Water management (Applied).
Identifiers: *Australia, *Hunter River (Australia).

Decisions must be made in designing for the conjunctive use of a reservoir and aquifer. Some of the methods available for analyzing system models and making these decisions are described. Details of a particular study using data from the Upper Hunter River, Australia serve to illustrate these methods. The practical difficulties involved can be largely overcome by field testing of the aquifer in the investigation stage of a project, or by a more refined application of the procedure several years after the start of implementing a project, when more data become available. (Knapp-USGS)
W71-03139

CITY OF PHILADELPHIA V PHILADELPHIA SUBURBAN WATER CO (COMPETING USES OF LIMITED RESOURCES).
For primary bibliographic entry see Field 06E.
W71-03233

4C. Effects on Water of Man's Non-Water Activities

LAND TREATMENT IN AGRICULTURAL WATERSHED HYDROLOGY RESEARCH,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
L. M. Glymph, and H. N. Holtan.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 271-298, January 1970. 28 p, 17 fig, 5 tab, 25 ref.

Descriptors: *Rainfall-runoff relationships, *Agricultural watersheds, *Demonstration watersheds, Mathematical models, Model studies, Management, Evapotranspiration, Watershed management, Water utilization.
Identifiers: Watershed models.

Studies of the hydrology of farm watersheds are reviewed with emphasis on relationships between treatment and runoff coefficients. The rate of runoff depends on the size and shape of the watershed, surface slopes, nature and amount of vegetation, soil permeability, initial soil saturation, arrangements and character of drainage channels, evaporation, storage and underground conditions, and the duration and intensity of rainfall. Experimental watershed research seeks to establish principles and describe them in numerical terms so that by knowing the geology, soils, topography, and characteristics of the stream channel system of an ungaged watershed, its performance may be predicted under various land use patterns and treatments when subject to an assumed single precipitation event or to a series of such events. A mathematical model for computing the components of watershed hydrology in their natural chronological and spatial sequences of occurrence is under study by the USDA Hydrograph Laboratory. (See also W70-04723) (Knapp-USGS)
W71-02812

WATER RESOURCES AND REGIONAL LAND-USE PLAN,
Harza Engineering Co., Chicago, Ill., Water Resources Planning Div.
For primary bibliographic entry see Field 06B.
W71-02903

CENTRAL OREGON COAST. VOLUME VI. RECREATION TOURISM.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 06B.
W71-03204

PENNSYLVANIA ENVIRONMENTAL COUNCIL, INC V BARTLETT (HIGHWAY RELOCATION ENDANGERS STREAM ECOLOGY).
For primary bibliographic entry see Field 06E.
W71-03258

4D. Watershed Protection

GEOCHEMICAL BALANCE OF A SMALL WATERSHED AND ITS GEOMORPHIC IMPLICATIONS,
Maryland Geological Survey, Baltimore; Vanderbilt Univ., Nashville, Tenn. Dept. of Geology; and Johns Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
For primary bibliographic entry see Field 02K.
W71-02761

SEDIMENTATION ENGINEERING, CHAPTER IV. SEDIMENT SOURCES AND SEDIMENT YIELDS.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 02J.
W71-02855

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02J.
W71-02874

FLOOD AND EROSION CONTROL (PROJECT AUTHORITY AND ADMINISTRATION).
For primary bibliographic entry see Field 06E.
W71-03261

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

WATER RESOURCES DATA FOR TEXAS, 1968 - PART 2. WATER QUALITY RECORDS.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02759

RELATIVE TOXICITIES OF SELECTED CHEMICALS TO SEVERAL SPECIES OF TROPICAL FISH,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W71-02829

MERCURY IN THE ENVIRONMENT.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02886

MERCURY CONTENT OF ROCKS, SOILS, AND STREAM SEDIMENTS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02888

ANALYTICAL METHODS FOR DETERMINATION OF MERCURY IN ROCKS AND SOILS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02896

TRITIUM FALLOUT IN THE PACIFIC UNITED STATES,
California Univ., Los Angeles. Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W71-02898

TRITIUM PROFILE AT THE NORTH PACIFIC (1969) GEOSECS INTERCALIBRATION STATION,
For primary bibliographic entry see Field 02K.
W71-02900

TRACE ELEMENT CALIBRATIONS AND PROFILES AT THE GEOSECS TEST STATION IN THE NORTHEAST PACIFIC OCEAN,
Woods Hole Oceanographic Inst., Mass.
For primary bibliographic entry see Field 02K.
W71-02901

METHODS OF ANALYZING OILFIELD WATERS: CESIUM AND RUBIDIUM,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
For primary bibliographic entry see Field 02K.
W71-02949

EXTRACTION AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES FROM LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
Michael G. Browman.
Wisconsin Water Resources Center, Madison, Ph D Thesis, 1970. 113 p, 5 fig, 19 tab, 104 ref. OWRR Project B-016-WIS (10); and USDA, ARS, Contract No 12-14-100-8154 (41).

Descriptors: *Separation techniques, *Lake sediments, *Insecticides, *Pesticides, Aldrin, Heptachlor, Dieldrin, DDT, *Gas chromatography, Analysis, Lakes, Wisconsin, Pollutant identification.
Identifiers: BHC, DDE, DDD, Methoxychlor, Aluminum oxides, Trout, Little Arbor Vitae, Tomahawk, Mendota.

The azeotropic hexane: acetone (41:59) mixture was adapted for extraction of organochlorine insecticides from lake sediments. Sediment samples are shaken twice with the extractant and the pooled extracts are washed with water. The insecticides in the hexane layer are concentrated to an appropriate volume and determine radiometrically or by gas liquid chromatography. Sediments from hard and soft water lakes were utilized in combination with the following insecticides: aldrin, gamma-BHC, heptachlor, heptachlor expoxide, p, p'-DDE, dieldrin, o, p'-DDT, p, p'-DDD, p, p'-DDT, and p, p'-methoxychlor. Best cleanup of extracts was achieved with basic and neutral aluminum oxides. The highest recovery of insecticides was obtained from samples spiked and extracted in the wet state. (See also W71-02979) (Chesters-Wisconsin)
W71-02978

THE PERSISTENCE AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES IN SOILS AND SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
William Trautmann.
Wisconsin Water Resources Center, Madison, Ph D Thesis, 1970. 138 p, 15 fig, 16 tab, 120 ref.

Descriptors: *Irradiation, *Degradation, *Soil properties, *Insecticides, Aldrin, Heptachlor, Dieldrin, Analysis, Pollutant identification.
Identifiers: Gamma-BHC, p, p'-DDD, p, p'-DDT, Beta-BHC, Subirrigated soils, Ella prairie loamy sand, Poygan lacustrine clay.

This study was concerned with the effect of soil moisture and irradiation on volatilization and degradation of selected organochlorine insecticides in soils and sediments of different composition. Sterile and non-sterile samples of sub-irrigated sandy prairie soil and lacustrine clay were spiked with a mixture of 6 insecticides and incubated under forced aeration for 30 days. Volatilization of gamma-BHC, aldrin, and heptachlor exposide was greater from sandy than from clay soil but failed to reveal the effect of treatment. Volatilization of dieldrin, p, p'-DDD and p, p'-DDT from both soils did not exceed 3%. A fraction of the gamma-BHC was transformed into the degradation by-product the beta-BHC. The uneven heat distribution within the oven of sweep codistillation units was corrected by an addition of a solid aluminum block with 4 Storherr tubes, 4 carrier gas preheat tubes, 2 heating elements, and a thermocouple. This modification eliminated chromatographic inaccuracies resulting from coextracted components of high R sub t values and permitted reproducible recovery of insecticides. (See also W71-02978) (Chesters-Wisconsin)
W71-02979

GENERAL LIMNOLOGICAL AND BIOLOGICAL STREAM SURVEYS AS A SIMPLE MEANS OF DETECTING POLLUTION AND CONTROLLING THEIR EFFECTS,
Landesstelle fuer Gewasserkunde, Karlsruhe (West Germany).
W. Schmitz.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 6 p, 3 fig, 1 tab, 3 ref.

Descriptors: *Water pollution control, *Classification, Water pollution effects, *Limnology, Organic wastes, Biochemical oxygen demand, Water quality control, Organic loading, Nitrites, *Monitoring, Dissolved oxygen, Pollutant identification, Control systems, *Bioindicators.
Identifiers: *Stream surveys, Germany, Oxygen supply, *Organic pollution load, *Water pollution criteria.

The degree of stream pollution is classified for streams of the Baden-Wurttemberg area of Germany by two methods: (1) Definitions of classes of organic pollution load and, (2) definition of classes of oxygen supply. To estimate the degree of organic pollution load some rather general criteria of the limnological character of the stream and simple observations of the flora and fauna are used. BOD NH4.., and NO2-ranges were given for each of the five pollution classes based on organic pollution load. Five pollution classes were given on the basis of oxygen supply (greater than 8 mg. O2/l., 6-8, 4-6, 2-4, and less than 2 mg. O2/l.) (Katz-Washington)
W71-03096

NITRATE AND AMMONIUM CONTENTS OF WISCONSIN LIMESTONES,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W71-03111

DETERMINATION OF MERCURY IN WATER,
Geological Survey, Denver, Colo.
Marvin J. Fishman.
Analytical Chemistry, Vol 42, No 12, p 1462-1463, October 1970. 2 p, 2 tab, 3 ref.

Descriptors: *Chemical analysis, *Trace elements, *Heavy metals, *Poisons, Water pollution, Pollutant identification, Spectrophotometry, Pollutant identification.
Identifiers: *Mercury.

A technique is described for the determination of mercury in fresh waters. Mercury is collected from an acidified water sample by amalgamation on a silver wire. The silver wire is then electrically heated in an absorption cell placed in the light beam of an atomic absorption spectrophotometer. The mercury vapors are drawn through the cell with a water aspirator and the absorption is plotted on a recorder. Samples containing at least 0.1 microgram of mercury per liter can be analyzed

directly; samples containing more than 1.5 microgram per liter must first be diluted. None of the substances commonly occurring in natural water interferes, although iron and sulfide, if present, cause low recovery of mercury. (Knapp-USGS)
W71-03114

CARBON DIOXIDE IN THE SURFACE WATER OF THE ICE-COVERED BERING SEA,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W71-03115

THE DETERMINATION OF SHORT-CHAIN FATTY ACIDS IN AQUEOUS SOLUTION BY GAS-LIQUID CHROMATOGRAPHY,
National Inst. for Water Research, Pretoria (South Africa).
J. J. Van Huyssteen.
Water Research, Vol 4, No 10, p 645-659, October 1970. 5 p, 8 fig, 1 tab, 83 ref.

Descriptors: *Pollutant identification, *Organic acids, *Anaerobic digestion, *Chromatography, Sewage treatment, Gas chromatography, Waste treatment, Analytical techniques, Chemical analysis.
Identifiers: *Short-chain fatty acids, *Gas-liquid chromatography.

A method is presented for the direct determination of short-chain fatty acids in aqueous solution by gas-liquid chromatography. A flame ionization detector is used with glass columns packed with a polystyrene-divinylbenzene resin. Complete separation of both the normal and iso-acids (from C2 to C6) was achieved. The linearity of the detector over the concentration range 0 to 2500 mg per liter for C2 and C3 and 0-1000 mg per liter for the C4 to C6 acids was also established. Per unit weight, acetic acid gave responses of the order of those of the higher homologues. Column characteristics (as evidenced by retention times and detector responses) remained unimpaired after well over 500 injections of fatty acid solutions, water and digester samples. (Knapp-USGS)
W71-03118

AUTOMATED ANALYSIS OF AMMONIA IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
J. E. Harwood, and D. J. Huyser.
Water Research, Vol 4, No 10, p 695-704, October 1970. 10 p, 6 fig, 1 tab, 38 ref.

Descriptors: *Pollutant identification, *Ammonia, *Color reactions, *Colorimetry, Chemical analysis, Water analysis, Nitrogen compounds, Ammonium compounds, Nitrogen, Analytical techniques.
Identifiers: Ammonia analysis.

An automated method to determine ammonia-nitrogen over a wide concentration does not require changes in manifold. Sensitivity is altered by changes in the reagents. The most sensitive determination is based on the use of nitro-prusside as catalyst over the range 0-1 mg NH3-N per liter using a 15 mm flowcell and no range scale expansion. The phenol-hypochlorite reaction is almost specific for ammonia-nitrogen. The effect of metal ions was also investigated. An adequate buffering system should be used to eliminate the effect of sample pH. (Knapp-USGS)
W71-03119

POLLUTION SURVEILLANCE AND DATA ACQUISITION USING MULTISPECTRAL REMOTE SENSING,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
Chester T. Wezernak, and Fabian C. Polcyn.
Water Resources Bulletin, Vol 6, No 6, p 920-934, November-December 1970. 15 p, 12 fig, 6 ref.

Descriptors: *Remote sensing, *Water pollution sources, *Pollutant identification, *Photometry, *Spectrophotometry, Instrumentation, Aircraft, Infrared radiation, Electromagnetic waves, Measurement, Surveys.
Identifiers: Multispectral remote sensing.

Large scale water resources investigations and effective pollution surveillance programs require the development of additional instrumentation and techniques to supplement existing methods of data acquisition. As a result, interest is growing in the concept of remote sensing. A passive multichannel scanner system is capable of sensing reflected and emitted energy simultaneously in a number of narrow spectral intervals in the ultraviolet, visible and infrared region of the solar spectrum. The system basically consists of a spectrometer for dispersing the radiation spectrally and filtered detector arrays placed at the focal points of a double ended optical-mechanical scanner. In the field of water pollution control remote spectral measurements can be used to detect and identify effluent discharge. Temperature is closely related to water pollution. The ability to detect small temperature differences can be used to locate effluent outfalls including submerged outfalls. An important feature of the instrumental system used in this investigation is the ability to examine a scene in 17 bands distributed between 0.3 and 13.5 microns. This means that in addition to the detection capability referred to above, the system serves as a 17 channel spectrometer with electronic processing features. Each effluent is more clearly defined by examination at its optimum wavelength; and, hence, dispersion patterns of the effluent are best determined within a particular spectral band width. (Knapp-USGS)
W71-03127

TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURUNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE SIZE OF FISHES (IN JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
Shoji Asano, Sumio Nagasawa, and Kazunobu Kondo.
English summary. Japanese Journal of Applied Entomology and Zoology, Vol 8, No 3, p 185-190, 1964. 6 tab, 4 fig, 3 ref.

Descriptors: *Bioassay, *Toxicity, Water pollution effects, Lethal limit, *Phenols, *Regression analysis, Mathematical studies, Laboratory tests.
Identifiers: *PCP, Dojo fish, Misgurunus anguillicaudatus, *Fish size effects, Body weight.

An improved method for eliminating the effect of variance in body weight on the result of the bioassay experiment of PCP for the 'Dojo' fish is presented. A linear relation was obtained between the log body weight of 'Dojo' fish and the log lethal time in various concentrations of PCP. The time at the average body weight of all fishes tested in the regression line mentioned above was considered as the median lethal time. The median lethal concentration derived from the relation between the median lethal time and log concentration coincided well with the result obtained by the usual median lethal concentration is evaluated at 24 hours after dipping. The median lethal concentration determination from large numbers mentioned above also coincided completely with that determined from small numbers. (Sjolseth-Washington)
W71-03188

5B. Sources of Pollution

EVALUATION OF EARTHLY MATERIALS FOR USE IN DECONTAMINATION OF WATER,
Auburn Univ., Ala. Water Resources Research Inst.
Joe B. Dixon.
Available from NTIS as PB-196 308, $3.00 in paper copy, $0.95 in microfiche. Auburn University Water Resources Research Institute Bulletin 703, 1970. 74 p. OWRR Project A-001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.
Identifiers: *Pesticide degradation, Amiben.

Endrin decomposition was greater on clays saturated with Al than those saturated with Ca, indicating that endrin decomposition will be increased by acidity of clay or soil. Increasing relative humidity generally reduced adsorption and decomposition of endrin. Endrin decomposition may be increased in sediments or soils by drying them by frequent tillage in a dry season. Diquat cations were 68 to 100% replace by K ions in soil clays. Some diquat may remain active in the presence of kaolinite and vermiculite. Sorption of the amiben anion was greatest for minerals with hydroxyl surfaces and least for 2:1 layer structured minerals. Greater leaching could occur in soils dominated by 2:1 type minerals. Sorption of the methyl ester of amiben was largely controlled by organic matter content regardless of clay minerals present. Many of the soils of the southeastern United States are acid and contain vermiculite and kaolinite as the major clay minerals. These soils may be effective in decomposing endrin, diquat, and other organic molecules. (See also W71-02753 thru W71-02756) (Knapp-USGS)
W71-02752

ENDRIN, DIELDRIN AND ALDRIN ADSORPTION AND DECOMPOSITION BY CLAY MINERALS AND SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
N. P. Agnihotri, and J. B. Dixon.
In: Auburn University Water Resources Research Institute Bulletin 703, p 4-20, 1970. 17 p, 3 fig, 1 tab, 29 ref. OWRR Project A-001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.
Identifiers: *Pesticide degradation, Amiben.

Adsorption and decomposition of endrin were determined on Ca- and Al-saturated reference clay mineral and soil clay samples at 48 and 100% relative humidity and in vacuum at different temperatures. More endrin was adsorbed and decomposed by Al-saturated clay samples than Ca-saturated clay samples at different humidities and in vacuum. Adsorption and decomposition of endrin were greatest in vacuum and declined with increasing relative humidity. Al-saturated vermiculite and montmorillonite adsorbed and decomposed more endrin than other clay minerals tested. Hematite and goethite adsorbed and decomposed the smallest amounts of endrin. Adsorption and decomposition of endrin by gibbsite were less than by silicate clay minerals and were much greater than by iron minerals. (See also W71-02752) (Knapp-USGS)
W71-02753

EXCHANGE OF DIQUAT CATIONS IN SOIL CLAYS, VERMICULITE AND MONTMORILLONITE WITH HOAI INTERLAYERS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
J. B. Dixon, D. E. Moore, N. P. Agnihotri, and D. E. Lewis, Jr.
In: Auburn University Water Resources Research Institute Bulletin 703, p 21-35, 1970. 15 p, 3 fig, 3 tab, 7 ref. OWRR Project A-0001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.

Identifiers: *Pesticide degradation, Amiben.

Clay samples were saturated with diquat cations by a centrifuge washing procedure. Diquat adsorbed was determined by difference. Exchangeable diquat was replaced by washing samples with KCl solutions. Exchange of diquat cations to KCl solutions was from 23 to 26% complete for three Wyoming montmorillonites and was from 35 to 44% for three model montmorillonites from southeastern United States. Diquat cations were 59% exchangeable in a nontronite. Diquat cations satisfied 53 and 82% of the cation exchange charge of two vermiculites. Eleven soil clays had from 27 to 98% of their cation exchange charge countered by diquat cations. The exchange of diquat from soil clays was from 68 to 100%. Montmorillonitic soil clays fixed more diquat than soil clays dominated by vermiculite, intergrade-chlorite and kaolinite. High layer charge density in montmorillonite and vermiculite contributes to diquat exchangeability in those minerals. The content of vermiculite in soil clays is directly related to diquat exchangeability. (See also W71-02752) (Knapp-USGS)
W71-02754

SORPTION OF AMIBEN AND THE METHYL ESTER OF AMIBEN BY CLAY MINERALS AND SOILS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
L. D. Spivey, and J. B. Dixon.
In: Auburn University Water Resources Research Institute Bulletin 703, p 36-51, 1970. 16 p, 1 fig, 5 tab, 13 ref. OWRR Project A-001-ALA (1).

Descriptors: *Chemical degradation, *Clay minerals, *Pesticides, *Pesticide kinetics, Adsorption, Alabama, Path of pollutants, Pesticide residues, Soil water movement, Translocation, Endrin, Diquat, Dieldrin, Aldrin, Soil chemical properties, Soil chemistry.
Identifiers: *Pesticide degradation, Amiben.

Kaolinite, halloysite, gibbsite, and goethite, at pH values of 4.4 to 5.3, sorbed 38 to 88% of the applied amiben. Little or no amiben was sorbed by illite and vermiculite. Treatment to remove iron oxides reduced sorption by soil clays. Sorption was greatest on acid soils high in kaolinitic clay. Amiben sorption by soils was reduced by application of sulfate and phosphate salts. The methyl ester of amiben was sorbed 3 to 30% by all reference clay minerals. Sorption of the amiben ester by soil was related primarily to organic matter percentage. (See also W71-02752) (Knapp-USGS)
W71-02755

GLYCEROL VAPOR ADSORPTION ON CLAY MINERALS AND MONTMORILLONITIC SOIL CLAYS,
Auburn Univ., Ala. Dept. of Agronomy and Soils.
D. E. Moore, and J. B. Dixon.
In: Auburn University Water Resources Research Institute Bulletin 703, p 52-73, 1970. 22 p, 3 fig, 2 tab, 18 ref. OWRR Project A-001-ALA (1).

Descriptors: *Adsorption, *Clay minerals, *Alcohols, *Pesticides, Laboratory tests, Expansive clays, Soils, Soil chemical properties, Pesticide kinetics, Pesticide residues, Sorption, Surfaces.
Identifiers: *Glycerol sorption (Clays).

Adsorption isotherms of glycerol were obtained for clay fractions of montmorillonite, vermiculite, kaolinite and eight soil clays at 80C in an evacuated system. Montmorillonite samples gave BET monolayer values from 211 to 230 mg glycerol per g of montmorillonite. Monolayer values calculated for soil montmorillonites from BET monolayer values and corrected for impurities were 209 to 239 mg glycerol per g of montmorillonite in soil clays. Vermiculite gave BET monolayer values of 40 mg and 96 mg per g of clay for 2 to 0.2 micron and 0.2 to 0.08 micron sizes. (See also W71-02752) (Knapp-USGS)
W71-02756

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN MADISON, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
Robert F. Kaufmann.
Available from NTIS as PB-196 360, $6.00 in paper copy, $0.95 in microfiche. Wisconsin Water Resources Center, Technical Report, University of Wisconsin, Madison, 1970. 361 p, 25 fig, 62 tab, 100 ref. OWRR Project A-018-WIS (1).

Descriptors: *Hydrogeology, *Landfills, Groundwater, Phosphorus, Nitrogen, Aquatic life, Discharge (Water), Dissolved oxygen, Wisconsin, Solid wastes, *Waste disposal, Groundwater recharge.
Identifiers: Flow systems, Stream standards, Urbanization, Leachate, Madison (Wis), Pumpage, Lake Monona (Wis), *Groundwater pollution, *Solid waste disposal, *Sanitary landfills.

Two existing, and 24 prospective, sanitary landfill sites in Madison, Wisconsin were examined. Former groundwater discharge characteristics of the existing sites have been altered as a result of the placement of fill and groundwater pumpage. Surface- and groundwater resources adjacent to landfill areas were found to receive pollutants although adverse effects were limited. Less than 5 per cent of the total organic and inorganic nitrogen and total soluble phosphorus entering Lake Monona was attributable to the landfill operation. Groundwater recharge was between 35 to 50 per cent of annual precipitation with lateral discharge to adjacent ground- and surface-water resources. The increase in dissolved chemical species was high, but restricted to local areas. Over the past 27 years, background quality in the two creeks receiving drainage changed by 10-22 fold decrease in organic nitrogen and 2-2.9 fold decrease in inorganic nitrogen. Phosphorus levels increased 2-6 fold. Decreased base flow and urbanization have possibly influenced these changes.
W71-02825

DDT IN A FRESHWATER MARSH: A SIMULATION STUDY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05C.
W71-02836

EFFECT OF THE SAVANNAH RIVER PLANT ON ENVIRONMENTAL RADIOACTIVITY.
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

Available from NTIS as DPST-70-30-1, $3.00 in paper copy, $0.95 in microfiche. Semiannual Report, July-December 1969. April 1970, 19 p. AEC AT (07-2)-1.
Identifiers: *Water pollution, Radiological contamination, *Nuclear power plants, *Radiological contamination, *Air pollution, Radiological contamination, Milk, Food, South Carolina.

The results are presented of the environmental monitoring program for the atmosphere, vegetation and food, milk, and water. The quantity of radioactive waste released by the Savannah River Plant to its environs was, for the most part, too small to be distinguished from natural background radiation or was obscured by fallout from offsite sources. Beta activity in air, which showed no relationship with plant operations, was about the same as that observed for the previous six-month period and was twofold higher than the same period of 1968. Radioactive materials in fish flesh continued to be far below levels considered significant from a health standpoint. The average concentration of any radionuclide in river water at Highway 301 did not exceed 0.4% of the concentration guide.
W71-02837

EVALUATION OF ACARICIDES FOR CONTROL OF THE STRAWBERRY SPIDER MITE ON COTTON AND ALFALFA,
Arizona Univ., Tucson. Agricultural Extension Service.
For primary bibliographic entry see Field 03F.
W71-02875

CHEMICAL, PHYSICAL AND BIOLOGICAL DYNAMICS OF NORTHERN PRAIRIE LAKES,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 05C.
W71-02880

MERCURY IN THE ENVIRONMENT.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: $0.70. Geological Survey Professional Paper 713, 1970. 67 p.

Descriptors: *Pollutant identification, *Trace elements, *Heavy metals, *Poisons, *Water pollution sources, Industrial wastes, Solutes, Chemical wastes, Analytical techniques, Neutron activation analysis, Chromatography, Colorimetry, Flame photometry, Surveys, Geochemistry, Reviews.
Identifiers: *Mercury.

The compounds of mercury, like many other chemical compounds, are dispersed throughout rocks, soil, air, water, and living organisms by a complex system of physical, chemical, and biological controls. Combinations of these controls have developed interesting patterns of mercury and its compounds in the world. Rain washes mercury from the atmosphere. Such scrubbing accounts for the fact that the mercury content of rainwater averages about 0.2 ppb. Tests in Sweden have shown that mercury carried down by rain adds to each acre of land per year about the same amount of mercury added by mercury-bearing seed dressing. Mercury from either source is held tightly by the upper 2 inches or so of soil. Surface waters except where they are influenced by manmade pollution, generally contain less than 0.1 ppb of mercury. Mercury from industrial processes in this country are estimated at 600 tons per year and superimpose a significant amount of manmade pollution upon the pattern established by nature. Mercury contents of many industrial outfalls and sludge banks range from a trace to 100,000 ppb. Several instances of human poisoning have been reported from consumption of fish exposed to local concentrations of mercury. The Geological Survey's analytical methods have progressed from improved wet chemical dithizone colorimetric method, through a series of spectrographic, atomic absorption, and activation analyses procedures, until it now is capable of measuring with confidence mercury concentrations as low as 1 part per trillion in the atmosphere and 0.1 ppb in water or earth materials. (See also W71-02887 thru W71-02896) (Knapp-USGS)
W71-02886

SUMMARY OF THE LITERATURE ON THE INORGANIC GEOCHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
Michael Fleischer.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 6-13, 1970. 8 p, 79 ref.

Descriptors: *Bibliographies, *Geochemistry, *Heavy metals, *Trace elements, *Poisons, Water pollution sources, Air pollution, Path of pollutants, Surveys, Reviews, Geochemistry, Water chemistry.
Identifiers: *Mercury.

The mercury content of most igneous rocks is generally less than 200 ppb and probably averages less than 100 ppb. Rocks from a few areas in the world, notably Crimea and the Donets Basin, U.S.S.R., show extremely high contents of mercury, which makes general averages of abundance of

doubtful significance. Most sedimentary rocks have mercury contents less than 200 ppb Hg. Most natural water (groundwater, river water, sea water) contain less than 2 ppb Hg. High concentrations of mercury have been found in waters from hot springs and in brines from a petroleum field in California. Mercury is presumably dissolved by groundwaters passing over rocks and is added to waters in considerable amounts by industrial wastes, notably by alkali-chlorine plants using the mercury cell method and by the paper pulp industry. The mercury is apparently removed in large part by adsorption on clays and on hydrous oxides of iron and manganese, and also by algae and plankton. Mercury is present in the atmosphere, with background values of less than 1 to a few nanograms per cubic meter. Over metallic ore deposits, the content of mercury is appreciably higher. Volcanic emanations have high contents of mercury, and must contribute a large amount of mercury to the atmosphere. In addition to such 'natural pollution', mercury is added to the atmosphere by the burning of coal and petroleum and from stack gases of smelters treating copper, lead, and zinc ores. (See also W71-02886) (Knapp-USGS)
W71-02887

MERCURY CONTENT OF ROCKS, SOILS, AND STREAM SEDIMENTS,
Geological Survey, Washington, D.C.
A. P. Pierce, J. M. Botbol, and R. E. Learned.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 14-16, 1970. 3 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Bibliographies, *Geochemistry, *Heavy metals, *Trace elements, *Poisons, Water pollution sources, Air pollution, Path of pollutants, Surveys, Reviews, Geochemistry, Water chemistry.
Identifiers: *Mercury.

Mercury is routinely determined in U. S. Geological Survey laboratories with atomic absorption equipment. Statistics are tabulated on mercury content of rocks, soils, and sediments as determined by the atomic absorption method, from 3 readily available sources: analytical data that are computer stored and that are immediately available for processing, data that have already been published, and data that are in the process of publication. A wide range from 10 to 6,000 ppb mercury, is seen in modal mercury values. This variability indicates that levels of natural mercury concentrations, or abundance, are relatively complex functions of geologic conditions and that criteria for either mercury mineralization or abnormal mercury contamination should be evaluated separately in any single area of interest. Less than 20 percent of the rock samples and stream-sediment samples have concentrations greater than 1,000 ppb mercury. For rocks and stream sediments the upper limit of the ranges of 90th percentiles indicate that any mercury values greater than 1,000 ppb are considered worthy of further investigation as possible results of (1) mercury mineralization processes or (2) surface contamination by mercury-bearing wastes. Statistics for only 4 sets of soil samples are available, and these suggest a background value of 500 ppb mercury for soils in Western United States. (See also W71-02886) (Knapp-USGS)
W71-02888

CHEMICAL BEHAVIOR OF MERCURY IN AQUEOUS MEDIA,
Geological Survey, Washington, D.C.
John D. Hem.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 19-24, 1970. 6 p, 2 fig, 11 ref.

Descriptors: *Water chemistry, *Heavy metals, *Geochemistry, *Trace elements, *Poisons, Water pollution sources, Path of pollutants, Reviews, Aqueous solutions, Biochemistry, Chemical reactions.
Identifiers: *Mercury.

The chemical behavior of the element mercury in water is highly interesting, although rather complicated and still not entirely explainable. A general statement of what is known and can reasonably be inferred about the aqueous chemistry of mercury is given. This review should aid in the interpretation of analyses for mercury in surface and groundwater and may help predict what will happen when mercury is added to river or lake water in waste-disposal processes. Mercury forms many solute species. Some of these are complex ions with a high degree of stability. A calculation of solubility for mercury must take into account a large number of possible forms. This situation is further complicated because of the possible existence of different oxidation states. Mercury in the form of liquid metal is somewhat volatile and can escape from systems open to the atmosphere, and many mercury compounds are somewhat volatile also. Mercury forms many strong organic complexes and is generally much more soluble in organic liquids than in water. Methyl mercuric ion is cited in publications by various authors as the most important form in fish and various other food products of animal origin. (See also W71-02886) (Knapp-USGS)
W71-02889

MERCURY CONTENTS OF NATURAL THERMAL AND MINERAL FLUIDS,
Geological Survey, Washington, D.C.
D. E. White, M. E. Hinkle, and Ivan Barnes.
In: Mercury in the Environment, Geological Survey Professional Paper 713, ' 25-28, 1970. 4 p, 16 ref.

Descriptors: *Water chemistry, *Heavy metals, *Geochemistry, *Trace elements, *Poisons, Water pollution sources, Path of pollutants, Reviews, Aqueous solutions, Biochemistry, Chemical reactions.
Identifiers: *Mercury.

Dilute thermal springs contain readily detectable mercury. The springs include high-temperature waters of Yellowstone National Park, which are closely associated with extensive Pleistocene volcanism. Some California thermal waters, and nonthermal waters of appreciable salinity but not closely associated with volcanism, contain mercury in the range of 1 to 3 ppb, concentrations notably higher than Yellowstone National Park waters. Sediments associated with some of these springs are rich in mercury, containing about 50 to 5,000 times the mercury content of ordinary rocks, and the mercury contained is presumed to have been transported by the spring water. Petroleum and especially the tarry residues of petroleum contain a range from 300 to 500,000 ppb. In the formation of some mercury deposits, petroleum and hydrocarbon gases apparently played a role, but the origin and nature of the fluids that have formed most large mercury deposits are not yet clearly understood. Data are incomplete for hot spring and volcanic gases, especially in view of anomalous contents of mercury in associated solid phases which indicates vapor transport. (See also W71-02886) (Knapp-USGS)
W71-02890

SOURCES AND BEHAVIOR OF MERCURY IN SURFACE WATERS,
Geological Survey, Washington, D.C.
R. L. Wershaw.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 29-31, 1970. 3 p, 22 ref.

Descriptors: *Water chemistry, *Heavy metals, *Geochemistry, *Trace elements, *Poisons, Water pollution sources, Path of pollutants, Reviews, Aqueous solutions, Biochemistry, Chemical reactions.
Identifiers: *Mercury.

Before one declares a water body polluted with waste mercury from man's activities, it is necessary to know the natural background level of the metal. Water samples were collected for this purpose by district offices of the U. S. Geological Survey, in cooperation with the Federal Water Quality Administration, during May, June, and July 1970. The 73 samples, representing surface waters in 31 states, range in concentration from less than 0.1 to 17 ppb. Of the total, 34 contained less than the detectable concentration (0.1 ppb). Of the remainder, 27 samples ranged from 0.1 to 1.0 ppb and 10 samples ranged from 1.0 to 5.0 ppb. Only two samples contained more than 5.0 ppb, the Public Health Service limit for potable water supplies. Natural surface waters contain tolerably small concentrations of mercury except in areas draining mercury deposits. Industrial, agricultural, scientific, and medical uses of mercury and mercury compounds introduce additional mercury into surface waters. Whatever its source, the concentration of mercury compounds, dissolved or suspended, is reduced rapidly by sorption and by complexing reactions with clays, plankton, colloidal proteins, humic materials, and other organic and inorganic colloids. These reactions tend to keep the concentration of dissolved mercury at levels near the normal background except at points of actual mercury discharge. (See also W71-02886) (Knapp-USGS)
W71-02891

BIOLOGICAL FACTORS IN THE CHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
Phillip E. Greeson.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 32-34, 1970. 3 p, 1 fig, 14 ref.

Descriptors: *Biochemistry, *Poisons, *Heavy metals, *Water pollution sources, *Water pollution effects, Toxicity, Public health, Chemical properties, Biological communities, Food chains.
Identifiers: *Mercury.

Although mercury is not considered to be an essential food material for organisms, it is incorporated into the body of the organism by virtue of its presence in the water. Mercury in living tissues is believed to be largely organic and primarily methyl mercury. Much of the inorganic and organic mercurial wastes from industrial effluents are converted by anaerobes into methyl mercury or dimethyl mercury. Methyl mercury tends to concentrate in living tissue and at critical concentration can be extremely toxic. Aquatic organisms, as well as man, will concentrate mercury within their bodies when the intake rate exceeds the elimination rates. The result, under these conditions, is a buildup with time to the extent that the accumulated mercury can become toxic and, eventually, lethal. (See also W71-02886) (Knapp-USGS)
W71-02892

MERCURY CONTENT OF PLANTS,
Geological Survey, Washington, D.C.
Hansford T. Shacklette.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 35-36, 1970. 2 p, 1 tab, 7 ref.

Descriptors: *Heavy metals, *Plants, *Poisons, Water pollution effects, Path of pollutants, Food chains, Trace elements, Plant physiology, Biochemistry.
Identifiers: *Mercury.

Plants growing in environments that have the normal small amounts of mercury probably seldom exceed 500 ppb mercury in their tissues. In environments that have significantly larger amounts of mercury because of the natural occurrence of mercury-bearing deposits, the plants may contain between 500 and 3,500 ppb mercury in their dried tissues. Much larger amounts of mercury may be found in plant samples as surficial residues or as deposits in the tissues as a result of intentional application of mercury compounds or from contamination. (See also W71-02886) (Knapp-USGS)
W71-02893

MERCURY IN THE ATMOSPHERE,
Geological Survey, Washington. D.C.
J. H. McCarthy, Jr, J. L. Meuschke, W. H. Ficklin, and R. E. Learned.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 37-39, 1970. 3 p, 3 fig, 7 ref.

Descriptors: *Trace elements, *Heavy metals, *Poisons, *Path of pollutants, *Air pollution, Geochemistry, Air circulation, Altitude, Winds, Volatility, Chemical reactions.
Identifiers: *Mercury.

Mercury in the atmosphere is derived from surface rocks and soils and from continuing hypogene and supergene processes. Elemental mercury results from either process, and owing to its relatively high vapor pressure, it is released to the atmosphere. More mercury is found in air over mercury deposits than elsewhere, and the rate of release of mercury over the deposits is determined by barometric pressure and temperature. The maximum content of mercury in air was found near midday; lesser amounts were found in the morning and evening; and minimum amounts were found near midnight. Background concentrations of mercury in air at 400 feet above ground in the Southwestern United States range from 3 to 9 ng/cu m. (See also W71-02886) (Knapp-USGS)
W71-02894

ATMOSPHERIC AND FLUVIAL TRANSPORT OF MERCURY,
Geological Survey, Washington, D.C.
E. A. Jenne.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 40-45, 1970. 6 p, 31 ref.

Descriptors: *Path of pollutants, *Heavy metals, Sediment transport, Winds, Streamflow, Water chemistry, Biochemistry, Chemical reactions, Solubility, Food chains, Solutes.
Identifiers: *Mercury.

Mercury enters the atmosphere in both gaseous and particulate forms. The mobility of mercury is greatly enhanced by a property which is unique among the metals, namely the relatively high vapor pressure of the metallic state and, to a lesser extent, certain of its compounds. Gaseous and particulate mercury are commonly contained in the exhaust fumes from various industrial and smelting processes. Presumably, the microbial methylation of mercury will increase the vapor phase loss of mercury. Where streams have incised mercury-bearing deposits, both solute and particulate mercury are released directly to the fluvial environment. In places, thermal springs, nonthermal springs, and mine drainage contribute significant amounts of mercury to streams. Mercury is being continuously removed from the atmosphere and deposited on the earth's surface by dry fallout and by rainfall. Solute mercury introduced into streams is quickly transformed to the particulate form by reduction to metallic mercury, by sorption on to inorganic sorbates, by complexation with nonviable particulate organics, and by sorption and ingestion by viable biota. (See also W71-02886) (Knapp-USGS)
W71-02895

ANALYTICAL METHODS FOR DETERMINATION OF MERCURY IN ROCKS AND SOILS,
Geological Survey, Washington, D.C.
F. N. Ward.
In: Mercury in the Environment, Geological Survey Professional Paper 713, p 46-49, 1970. 4 p, 15 ref.

Descriptors: *Pollutant identification, *Trace elements, *Heavy metals, *Poisons, *Water pollution sources, Industrial wastes, Solutes, Chemical wastes, Analytical techniques, Neutron activation analysis, Chromatography, Colorimetry, Flame photometry, Surveys, Geochemistry, Reviews.
Identifiers: *Mercury.

The mercury content of most uncontaminated solid earth materials is between 10 ppb and 500 ppb, and for water resources, generally is less than 0.1 ppb. To be useful, any analytical method must be at least sensitive enough to detect as little as 10 billionths of a gram and in some analyses one or two orders of magnitude less. Using the best applicable methods, analytical limitations of the methods are 10 ppb for rock and soils and 0.1 ppb for aqueous solutions if 100 ml of sample is used. An exception to this statement is the neutron activation method which may reach 0.05 ppb for water and sediment samples. Among the applicable techniques, including kinds of separations as well as final measurements, are those based on molecular and atomic absorption, molecular and atomic emission, catalysis, nephelometry, polarography, and activation to produce measurable decay products. Emphasis is on procedures used by the U. S. Geological Survey. Dithizone forms a highly colored and extractable species with Hg. As little as 0.012 microgram Hg per square centimeter gives a measurable absorbance. The dithizone reaction is the basis of the first practicable field method for determining traces of mercury. (See also W71-02886) (Knapp-USGS)
W71-02896

DRAINAGE AND POLLUTION FROM BEEF CATTLE FEEDLOTS,
Cornell Univ., Ithaca, N.Y., Dept. of Civil Engineering.
Raymond C. Loehr.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7726, p 1295-1309, December 1970. 15 p, 4 fig, 1 tab, 26 ref.

Descriptors: *Water pollution sources, *Cattle, *Farm wastes, *Confinement pens, Drainage, Rainfall, Runoff, Surface waters, Groundwater, Sanitary engineering, Pollution abatement.
Identifiers: *Feedlots, *Beef cattle feedlots.

Growth has taken place in the size of operations producing beef cattle for slaughter and in the water contamination problems associated with the drainage from feedlots. Data are presented on the quality and quantity of runoff that can occur at a feedlot. Runoff contains high concentrations of pollutants and occurs as a slug load on the resources of a stream. Because of the intermittent nature of the runoff, minimum control using retention ponds is possible. At a feedlot, major fraction of rain becomes runoff. Runoff coefficients of greater than 0.88 are shown. Groundwater pollution is another problem, and is discussed briefly. (Woodard-USGS)
W71-02902

MOVEMENT OF BACTERIA FROM A RIVER TO A MUNICIPAL WELL--A CASE HISTORY,
Geological Survey, Albany, N.Y.
Allan D. Randall.
Journal American Water Works Association, Vol 62, No 11, Part 1, p 716-720, November 1970. 5 p, 5 fig, 4 ref.

Descriptors: *Path of pollutants, *Induced infiltration, Coliforms, Alluvial channels, Dredging, Excavation, Aquifers, Gravels, Aquitards, Pumping, Water wells, Municipal water, Surface-groundwater relationships, Groundwater movement.
Identifiers: *Susquehanna River (NY), Binghamton (NY).

Coliform bacteria regularly travel at least 180 ft to municipal well from a reach of the Susquehanna River (NY) polluted by sewage. Excavation of the riverbed, in an area already geologically favorable for induced infiltration, seems responsible for bacteria reaching the well, after 19 yr of trouble-free operation. The well produces from beds of coarse sand and gravel and 10 to 80 ft below land surface. From 1945 through 1964 it was in daily use, with only occasional interruptions due to equipment failure, supplying 1.0 to 1.6 mgd of good water. (Knapp-USGS)
W71-02909

DISPERSAL OF PLATING WASTES AND SEWAGE CONTAMINANTS IN GROUNDWATER AND SURFACE WATER, SOUTH FARMINGDALE - MASSAPEQUA AREA, NASSAU COUNTY, NEW YORK,
Geological Survey, Washington, D.C.
N. M. Perlmutter, and Maxim Lieber.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402. Geological Survey Water-Supply Paper 1879-G, 1970. 67 p, 10 fig, 5 plate, 9 tab, 30 ref.

Descriptors: *Path of pollutants, *Groundwater movement, *Industrial wastes, *Chromium, *New York, Dispersion, Mixing, Heavy metals, Surveys, Surfactants, Hydrogeology, Aquifers, Water quality, Recharge, Data collections, Hydrologic data.
Identifiers: *Plating wastes, *Nassau County (NY).

Plating wastes containing cadmium and hexavalent chromium have seeped down from disposal basins into the upper glacial aquifer of Nassau County, N. Y. intermittently since 1941. This seepage has formed a plume of contaminated water about 4,300 feet long, 1,000 feet wide, and 70 feet thick. The plume extends downgradient to the headwaters of Massapequa Creek, a small stream which forms a natural drain for part of the contaminated groundwater, while the remainder moves slowly downgradient as underflow beneath and parallel to the stream channel. The maximum observed concentration of hexavalent chromium in the groundwater was about 40 milligrams per liter in 1949, but since the start of Chromium-treatment operations in 1958, concentrations of chromium have deceased to less than 5 mg/liter in most of the plume. No public-supply wells have been contaminated by metal-plating wastes. Natural velocity and direction of the groundwater movement account for most of the longitudinal spread, and the pattern and rate of injection of the plating wastes and the heterogeneity of the deposits account for most of the lateral spread of the contaminants. The vertical extent of the contaminants is controlled chiefly by the head relations at and near the disposal basins, the vertical permeability of the beds, and the natural regional flow pattern. (Knapp-USGS)
W71-02922

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
L. M. Libby.
Available from NTIS as AD-712 722, $3.00 in paper copy, $0.95 in microfiche. Report P-4415, Sept 1970. 67 p.
Identifiers: *Environment, Corrections, *Air pollution, Reviews, *Water pollution, Problem solving, Supersonic flight, DDT, Urban planning, Respiratory diseases, Radioactive waste, Carbon dioxide, Disposal, Wastes (Industrial), Sewage, Lead, Law, Climatology, Helium, Transportation, Arctic regions, Mining engineering, Oceans, Echinodermata, Ice fog, Carbon monoxide, *Environmental surveys, *Thermal pollution, *Oil pollution, Smog, Weather modification, Petroleum pipelines, Strip mining, Eutrophication, Starfishes, Domes (Structural forms.

The paper surveys some of the most recognizable and pressing problems of the environment, and includes comments on them from the current literature. Topics include short articles on pollution involving SST and stratospheric Air Force planes, heat, DDT, Airports, Design of satellite-city systems, Respiratory diseases, and smog, Radioactive waste disposal methods, Constructive use of garbage, Indemnity payments by air polluters, Phosphorus in waste waters, Constructive use of sewage, Biologic effects of lead, Clean-up of fuel oil, Weather modification, Ocean pollution, Reuse of golf courses, graveyards, and railroad properties, City slums, Resources of continental shelves, Hot pipeline in arctic, Los Angeles and earthquakes, Weather and CO2, Dome over Manhattan, Exter-

mination genus rattus, Helium, Eutrophication, Law for pollution control, Atmospheric CO, Starfish and its control, Oil spills, Logging, Tundra lands, and Ice fog.
W71-02953

THE PERSISTENCE AND ANALYSIS OF ORGANOCHLORINE INSECTICIDES IN SOILS AND SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05A.
W71-02979

RADIOACTIVITY AND A PROPOSED POWER PLANT ON CAYUGA LAKE.
Citizens Committee to Save Cayuga Lake, Ithaca, N.Y.

Citizens Committee to Save Cayuga Lake, Ithaca, New York, 1968. 16 p, 1 fig, 2 tab, 28 ref.

Descriptors: *Radioactivity, *Powerplants, *New York, Nuclear powerplants, Radioactive wastes, Uranium radioisotopes, Cooling, Gamma rays, Iodine radioisotopes, Strontium radioisotopes, Tritium, Gases, Cobalt, Cesium, Water quality, Genetics, Radiation.
Identifiers: *Cayuga Lake (N Y), Beta particles, Plutonium, Krypton radioisotopes, Xenon, Barium radioisotopes, Concentration factors.

The Citizens' Committee to Save Cayuga Lake was formed to protect their environment from radioactive waste contamination. The proposed Bell Station (nuclear power plant) is of such capacity and precise design not duplicated elsewhere and the proposed site is relatively small, slow-flushing Cayuga Lake (N Y). Radionuclides in quantities below AEC-established maxima will routinely be discharged into the atmosphere and lake, to be concentrated by aquatic organisms, and probably further concentrated in localized areas by currents, eddies, and winds. Radiation exposure of every person using the lake will be slightly increased by normal operation of the plant. It is possible to reduce or prevent routine discharges of radionuclides to the environment if operational procedures proposed by the company were revised. The local population has not been informed of the risks to itself and its environment inherent in operation of Bell Station or of costs necessary to avoid some of those risks. The utility should provide the public with estimates of risks involved in normal operation and an estimate of injury and property damage resulting from a serious accident. (Jones-Wisconsin)
W71-03025

COPPER IONS AS POISON IN THE SEA AND IN FRESHWATER,
Copenhagen Univ., Hillerod (Denmark). Freshwater Biological Lab.
E. Steemann Nielsen, and S. Wium-Andersen.
Marine Biology, Vol 6, No 2, p 93-97, 1970. 4 fig, 20 ref.

Descriptors: *Copper, *Ions, *Poisons, *Sea water, *Fresh water, Algae, Photosynthesis, Organic matter, Plankton, Chelation, Carbon radioisotopes, Chlorella, Growth rates, Diatoms, Phytoplankton, Toxicity, Iron, Light, Hydrogen ion concentration.
Identifiers: Chlorella pyrenoidosa, Nitzschia palea, Skeletonema costatum.

During the last two years intensive experimental work has been applied in investigations of the influence of ionic copper on photosynthesis and growth of green alga, Chlorella pyrenoidosa and the diatom, Nitzschia palea. Copper in ionic form is found to be very toxic to photosynthesis and growth of unicellular algae at concentrations usually found in natural waters, indicating that copper is not ordinarily present in ionic form but is complexed by organic matter such as polypeptides. The affinity of copper to diethyl-dithiocarbaminate is very much higher than to the organic matter which complexes copper in nature, thus it is not possible to distinguish the two forms of copper during analysis. Complexed copper is not poisonous to algae. It has recently been shown that ocean water in the centers of upwelling becomes suitable for plankton growth only after the addition of a chelator, suggesting that a large part of the copper found in subsurface waters of oceans is present in ionic form. Some manufacturers of carbon-14 ampoules have used ordinary distilled water which often has a content of about 250 micrograms copper per liter; thus, it is probable that some productivity measurements have been influenced. (Jones-Wisconsin)
W71-03027

TRANSPORT OF ORGANIC INSECTICIDES TO THE AQUATIC ENVIRONMENT,
Washington State Univ., Pullman.
E. Hindin, and P. J. Bennett.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 16 p, 9 tab, 17 ref.

Descriptors: *DDT, *Pesticide residues, *Pesticide drift, *Pesticide kinetics, Chlorinated hydrocarbon pesticides, On-site investigations, Columbia River Basin, Soil analysis, Water analysis, Gas chromatography, Silts, Analytical techniques, *Irrigation water, Absorption, Drainage effects, Drainage water, *Surface runoff, *Persistence, Organophosphorus pesticides, Water pollution sources.
Identifiers: DDD, DDE, *Ethion, *Pesticide transport, *Setteable silt.

A five-year study was undertaken to assess quantitatively the amount of DDT and ethion removed from a treated plot. Persistent insecticides such as DDT applied to the soils were found to be carried over in the soil from one growing season to the next, although the quantity was greatly diminished. Less conclusive evidence was found for the organophosphorus pesticide, ethion. Surface drainage has the ability to dissolve and carry (by absorption) insecticides in a suspension for great distances. The quantity of insecticides transported away via the surface drainage and water-borne settleable silt was extremely small compared to the amount of each insecticide residing in the soil. The authors stress the point that DDT will remain in the soil and thus in the surface drainage for many years. (Sjolseth-Washington)
W71-03093

OIL SLICK MOTION NEAR CHESAPEAKE BAY ENTRANCE,
Virginia Inst. of Marine Science, Gloucester Point.
John C. Munday, Jr., Wyman Harrison, and William G. MacIntrye.
Water Resources Bulletin, Vol 6, No 6, p 879-884, November-December 1970. 6 p, 2 fig, 1 tab, 19 ref.

Descriptors: *Oily water, *Path of pollutants, Fuels, Winds, Tides, Currents (Water), Tracking techniques, Movement, Water pollution sources, Water pollution effects.
Identifiers: *Chesapeake Bay, *Oil slicks.

Five-to-50-gallon slicks of No. 6 (Bunker C) fuel oil were tracked near Chesapeake Bay entrance for several hours on six different occasions. Slick motion was due mainly to surface currents. The slick wind factor varied with wind speed, showing a threshold at seven knots and approaching 2.0% at 20 knots. Published values of 2.3 to 5% did not exclude the effects of wind-generated surface currents. Prediction of slick motion using wind and published tidal-current data was deficient; accuracy will require extensive wind and surface-current time-series data. (Knapp-USGS)
W71-03123

SCHLICHTRULL V MELLON-POLLOCK OIL CO (NEGLIGENT DRILLING OF OIL WELL ALLEGED TO HAVE CAUSED SALINE WATER INTRUSION).
For primary bibliographic entry see Field 06E.
W71-03230

UNITED STATES V FLORIDA POWER AND LIGHT CO (THERMAL POLLUTION OF BISCAYNE BAY).
For primary bibliographic entry see Field 06E.
W71-03260

THE COLOMBO (DISCHARGE OF OIL INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-03274

THE MERCURY POLLUTION PROBLEM IN MICHIGAN AND THE LOWER GREAT LAKES AREA (A SUMMARY OF INFORMATION AND ACTION PROGRAMS),
Michigan Water Resources Commission, Lansing.
For primary bibliographic entry see Field 05G.
W71-03294

5C. Effects of Pollution

RELATIVE TOXICITIES OF SELECTED CHEMICALS TO SEVERAL SPECIES OF TROPICAL FISH,
Hawaii Univ., Honolulu. Water Resources Research Center.
Jerry H. Nunogawa, Nathan C. Burbank, Jr., Reginald H. F. Young, and L. Stephen Lau.
Available from NTIS as PB-196 312, $3.00 in paper copy, $0.95 in microfiche. Technical Report No 40, August 1970. 38 p, 14 tab, 6 fig, 35 ref. OWRR Project A-018-HI (1).

Descriptors: Bioassay, *Toxicity, *Insecticides, *Fish toxins, Tilapia, Fish, Toxins, DDT, Dieldrin, Phenols, *Hawaii, Water pollution effects.
Identifiers: Near-shore fish, Mosquito fish, Guppies, *Tropical fish, Aholshole, Nehu, Lindane.

This study determined the 24, 48, 96-hour median tolerance limit of phenol, DDT, dieldrin, and lindane of five species of fish commonly found in streams and estuaries in semi-tropical areas. They are: (1) Gambusia affinis - mosquito fish, (2) Lebistes reticulatus - guppies, (3) Tilapia mossambica - tilapia, (4) Kuhlia sandvicensis - aholehole, and (5) Stolephorus purpureus - nehu. Of the five species, Gambusia affinis had the highest tolerance to the toxic agents used in this study. Lebistes reticulatus and Tilapia mossambica had approximately the same sensitivity to DDT as well as dieldrin and lindane. Lebistes reticulatus had a higher sensitivity to phenol than Tilapia mossambica. Although Stolephorus purpureus, nehu, was highly sensitive, Kuhlia sandvicensis was most sensitive to all toxic agents used.
W71-02829

DDT IN A FRESHWATER MARSH: A SIMULATION STUDY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
L. L. Eberhardt, R. L. Meeks, and T. J. Peterle.
Available from NTIS as BNWL-1297, $3.00 in paper copy, $0.95 in microfiche. BNWL-1297, March 1970. 54 p, 9 tabs, 30 fig, 110 ref.
Identifiers: *Water pollution, DDT, *Ecology, *DDT, Tracer studies, Mathematical models, *Food chains, Chlorine 36.

A computer simulation model has been constructed to represent the dynamics of chlorine-36 labelled DDT in a Lake Erie marsh. An exponentially decreasing input function (representing release of DDT from the granular formulation in which it was applied) determines concentration in water, from which one- or two-compartment models represent the concentration in various forms of flora and fauna. Observational data on 10 plant species, 6 invertebrates, and 3 vertebrate species were modelled. Five species (a plant, an invertebrate species, and the 3 vertebrates) were used

for a food-chain simulation. The overall results generally suggest that simple models, of the kind used to study radionuclide transfer through food chains, will provide reasonably good representations of the behavior of DDT in food chains. Controlled experiments are needed to properly identify the components of a model, and that a number of questions about sampling methodology remain unanswered.
W71-02836

INFLUENCE OF MINERALS ON SR90 AND CS137 UPTAKE BY BEAN PLANTS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
H. Nishita, R. M. Haug, and M Hamilton.
Soil Science, Vol 105, No 4, April 1968, p 237-243. 4 tab, 3 fig, 19 ref.

Descriptors: *Soil contamination, *Water pollution sources, *Radioactive wastes, *Fallout, *Absorption, Soil-water-plant relationships, Stontium radioisotopes, Cesium, Beans, Bentonite, Illite, Kaolinite, Soil chemical properties, Soil physical properties, Radioisotopes, Hazards, Leaves, Crop production, Soil amendments, Loam, Calcium, Potassium, Cation exchange, Plant physiology, Treatment.
Identifiers: *Radioactive materials, *Dispersed radionuclides, *Radiological hazard control, Clinoptilolite, Verxite, Vermiculite, Bauxite.

One of the problems with biosphere contamination with radioactive materials is contending with dispersed radionuclides at biologically hazardous levels. To minimize transfer of radionuclides along soil-water-plant-animal food chains leading to man, various methods of crop residue, and surface soil removal, plowing, soil amendments, and crop changes have been studied. This paper discusses the influence of addition of clinoptilolite, 'Verxite,' bentonite, illite, kaolinite, vermiculite and bauxite on Sr90 and Cs137 uptake by bean plants grown in two contaminated soils. Cs137 uptake was small compared to Sr90 uptake with all mineral treatments. Clinoptilolite had the greatest effect on both radionuclides. Sr90 uptake was significantly reduced while Cs137 uptake was increased. Effect of other minerals was nil; in no case was plant yield increased. Soil type is one of the important factors in radiological hazard control. Tables show soil and mineral properties, Cs137 and Sr90 activities with different treatments and ratios on leaves, and average bean weight after treatment. Figures of yield with mineral treatment, and uptake rates are shown. (Popkin-Arizona)
W71-02867

CHEMICAL, PHYSICAL AND BIOLOGICAL DYNAMICS OF NORTHERN PRAIRIE LAKES,
South Dakota State Univ., Brookings.
John G. Nickum.
Available from NTIS as PB-196 357, $3.00 in paper copy, $0.95 in microfiche. Completion Report, Water Resources Institute, South Dakota State University, Brookings, December 1970. 38 p, 3 tab, 10 fig, 23 ref. OWRR Project B-002-S DAK (4).

Descriptors: *Water quality, *Lakes, *Eutrophication, Phytoplankton, Plankton, Productivity, Primary productivity, Iced lakes, Ions, Sulfates, Carbonates, Bicarbonates, Diatonics, Cyanophyta, Algae, South Dakota, Water pollution effects, Water pollution sources, Cultivation.
Identifiers: Lake Herman (S. Dak), Enemy Swim Lake (S. Dak).

Water samples and samples of plankton were collected from Lake Herman and Enemy Swim Lake, both located in eastern South Dakota, from July, 1967 through June, 1970. All samples were analyzed for selected chemical characteristics and for phytoplankton population. Results indicated that both lakes are eutrophic but Lake Herman is considerably more productive than Enemy Swim. Concentrations of most ions were from 50 per cent to 100 per cent greater in Lake Herman than in Enemy Swim and phytoplankton populations were often 100 times more dense in Lake Herman. Relative abundance of major ions were similar in both lakes except that sulfate was the dominant anion in Lake Herman and bicarbonate - carbonate in Enemy Swim. Both lakes showed uniform chemical conditions from one sampling station to another and similar annual dynamics marked by a sharp increase to peak levels of all major ions under ice cover. Phytoplankton populations were dominated by blue-green algae in Lake Herman, and by diatoms in Enemy Swim. Numbers and kinds of algae varied from season-to-season and from year-to-year indicating that intensive long term sampling is necessary in any study of plankton dynamics in these lakes. The greater eutrophication of Lake Herman appears related to the intensive cultivation of its watershed.
W71-02880

MERCURY IN THE ENVIRONMENT.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02886

BIOLOGICAL FACTORS IN THE CHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02892

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05B.
W71-02953

STUDIES ON THE INTERACTIONS OF AQUATIC BACTERIA AND AQUATIC NEMATODES,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W71-03013

BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03021

NUTRIENTS AND QUALITY IN IMPOUNDED WATER,
Illinois State Water Survey, Peoria. Water Quality Section.
Wum-Cheng Wang, and Ralph L. Evans.
Journal American Water Works Association, Vol 62, No 8, p 510-514, 1970. 8 fig, 3 tab, 15 ref.

Descriptors: *Nutrients, *Water quality, *Impounded waters, Streams, Flow, Seasonal, Stratification, Nitrates, Silica, Ammonia, Phosphates, Runoff, Illinois, Hydrogen ion concentration, Alkalinity, Hardness (Water), Sampling, Diatoms, Nitrogen, Bacteria, Algae, Thermal stratification, Dissolved oxygen, Hypolimnion.
Identifiers: Lake Bloomington (Ill), Chemostratification.

An extensive study was made of impounded Lake Bloomington (Illinois), as significant changes occur in stream water quality when they are impounded. With few exceptions concentration of each constituent decreases with passage through the impoundment. Major influences within the system observed were stream flow, seasonal patterns, and stratification. Nitrate nitrogen and silica concentration increased with increasing stream flow. Ammonia-nitrogen and orthophosphate concentration were minimal. Since these constituents were principally derived from agricultural runoff the relative mobility of each in soil, appears clear. Nitrate nitrogen and phosphorus contributions to the water system represented 8.3% and 0.1%, respectively, of that applied to the drainage area. During warm weather, organic nitrogen concentrations were highest while nitrate-nitrogen was minimal, suggesting influence of biological activity. Difference between rate of nitrate-nitrogen and silica concentration reduction, though of the same origin, also suggested influence of biological uptake. Within the impoundment, stratification appeared the governing influence, as evidenced by changes in nitrate nitrogen and silica concentration with depth. Further insight into the interrelationships would appear to permit intelligent flexibility on the part of water works management. (Jones-Wisconsin)
W71-03028

RAPIDLY LABELED POLYPHOSPHATES AND METAPHOSPHATES IN THE BLUE-GREEN ALGA ANACYSTIS NIDULANS (IN GERMAN),
Technische Hochschule, Hanover (West Germany). Inst. for Botany.
For primary bibliographic entry see Field 07B.
W71-03033

SIMULATING THE EFFECT OF SINKING AND VERTICAL MIXING ON ALGAL POPULATION DYNAMICS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
David A. Bella.
Journal Water Pollution Control Federation, Vol 42, No 5, Part 2, p R140-R152, 1970. 1 fig, 1 tab, 17 ref.

Descriptors: *Mathematical models, *Algae, *Population, Dynamics, Lakes, Dissolved oxygen, Nutrients, Cyanophyta, Mixing, Phytoplankton.
Identifiers: *Algal sinking, *Vertical mixing, Euphotic zone, Diffusion coefficient, Lake Sammamish (Wash).

The developed simulation model describes the combined effect of growth, sinking, and vertical mixing on dynamics of algal population of lakes. Small differences in sinking velocities may significantly increase the growth of algae. A lowering of sinking often leads to an invasion of a less objectionable phytoplankton. Vertical mixing increases the density of algae and may result in transformation of the entire community. Artifical mixing may serve as an aid in control of algae, but the homogenization of environment is apt to reduce the species diversity at all trophic levels. (Wilde-Wisconsin)
W71-03034

MOVEMENT OF PHOSPHATE AND OTHER IONS FROM AND THROUGH LAKE MUDS,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 02H.
W71-03045

CULTURAL EUTROPHICATION: THE NATURE OF THE PROBLEM AND SOME RECOMMENDATIONS FOR ITS STUDY AND CONTROL,
Florida Univ., Gainesville. Dept. of Environmental Engineering.
Patrick L. Brezonik.
Department of Environmental Engineering, University of Florida, Gainesville, Undated. 26 p, 5 tab, 51 ref. OWRR Project B-004-FLA (2).

Descriptors: *Lakes, *Eutrophication, *Water pollution control, *Water pollution sources, *Water pollution effects, Water utilization, Analytical techniques, Nutrients, Nitrogen, Phosphorus, Agriculture, Water management (Applied), Geochemistry, Soil types, Hydrology, Climates, Trophic level, Nitrogen fixation, Forest, Winds, Light, Temperature, Hydrogen ion concentration, Dissolved oxygen, Chlorophyll, Algae, Conductivi-

ty, Sediments, Benthic fauna, Recreation, Bioassay, Fungi, Viruses.
Identifiers: *Cultural eutrophication, Trophic indicators, Nutrient budget.

The causal changes in water quality from pre-industrial man to present high-density populations are described. Of desirable techniques, mathematical models and bioassays make possible comparisons of the nutritional status of the different species of algae microscopically, by cytochemical staining of enzymes. The field of paleolimnology points out the differentiation of natural and cultural effects on lakes. Study of sediment cores gives a basis for comparison in eutrophication development. Bloom-forming blue-green algae characteristics point to need of knowledge of algal physiology. The best solution to the problem of cultural eutrophication is elimination of nutrients from source waters. In restoring lakes, methods of preventing nutrient release from sediments, and research on effectiveness of providing game fish spawning and feeding areas is needed. Refining the tools for lake management, including legal developments in shoreland corridor zoning are prerequisites. Greater accuracy is needed in predicting response of a lake to a given nutrient input or to changes in land utilization to make possible lake basin zoning and development of land use patterns on a rational basis. (Jones-Wisconsin)
W71-03048

THE EFFECT OF WATER QUALITY ON THE METABOLISM OF THE LACTIC STREPTOCOCCI,
Virginia Polytechnic Inst., Blacksburg. Dept. of Biology.
Robert E. Benoit.
Water Resources Research Center, Virginia Polytechnic Institute, Blacksburg, Bulletin 13, 1968. 64 p, 11 fig, 5 tab, 64 ref, append. OWRR Project A-005-VA (3).

Descriptors: *Water pollution effects, *Fermentation, *Lactobaccilus, Streptococcus, Cultures.
Identifiers: *Cheese industry, Streptococcus lactis, Streptococcus lactis var tardus 3.

The quality of water in certain parts of Virginia and neighboring states causes considerable difficulties in various microbial fermentations. This is particularly true of the cheese industry, because in the presence of water pollutants, the mutant cells of Streptococcus lactis selectively become the dominant lactic streptococci. These cells, designated as S lactis var tardus, have an impaired ability to ferment lactose and produce, besides lactic acid, considerable amounts of acetic and formic acids. This undesirable course of fermentation was precluded by deionization of water used in the preparation of microbial media, and also by rotation of starter cultures with cultures originated in different geographical regions. Analyses of growth curves, the pH changes, and the individual acid production on a lactose-yeast extract-phosphate medium permitted a differentiation of S lactis ATCC 11454 and var tardus 3. (Wilde-Wisconsin)
W71-03055

UTILIZATION OF ALKOXYSILANES FOR REDUCTION OF THE ABUNDANCE OF PHYTOPLANKTON DURING 'BLOOMS' OF WATER BASINS (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 05F.
W71-03056

EFFECTS OF CONTROLLED NUTRIENT DILUTION ON THE EUTROPHICATION OF A LAKE,
Washington Univ., Seattle. Dept. of Civil Engineering.
Ray T. Oglesby.
Eutrophication: Causes, consequences, corrective, p 483-493. Printing and Publishing Office, National Academy of Sciences, Washington, DC, 1969. 4 fig, 3 tab, 9 ref. FWPCA Grant No WPD 38-01 (RI).

Descriptors: *Eutrophication, *Lakes, Phosphorus, Nitrate, Nitrogen, Magnesium, Sodium, Alkalinity, Hardness (Water), Diversion.
Identifiers: Aphanizomenon, Anabaena, Gleotrichia, Green Lake (Wash), Dilution rate.

To decrease the level of eutrophication, the City of Seattle (Washington), diverted into neighboring Green Lake some of its municipal water. Since 1962 about 6.5 billion gallons have been flushed through the lake. In 1965-1966, the effect of this dilution was expressed in decrease of the total and orthophosphorus, nitrate nitrogen, magnesium, sodium, alkalinity, and total hardness, but an increase in calcium and potassium. With the exception of September and October, the water markedly improved its transparency. The virtual disappearance of the primary nuisance Aphanizomenon holsaticum and a reduction of Gleotrichia echinulata was partly offset by an increase in the relative abundance of Anabaena circinalis. (See also W70-03975) (Wilde-Wisconsin)
W71-03057

QUANTITATIVE ESTIMATION OF MIGRATORY FISH SURVIVAL UNDER ALTERNATIVE WATER QUALITY CONTROL PROGRAMS,
Federal Water Quality Administration, Edison, N.J.
A. R. Morris, and G. D. Pence.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint. 11 p, 8 fig, 3 tab, 15 ref.

Descriptors: Estimating, Fish management, Delaware River, Water pollution control, Statistical models, Anadromous fish, Water quality, Fishkill, Water pollution effects, Computer models, Fish migration, Dissolved oxygen, Mathematical model, Biochemical oxygen demand, Estuarine environment, Water quality control.
Identifiers: Shad, Alosa sapidissima, Dissolved oxygen model, Fish survival.

The objective of this study was to develop a reasonable and attainable management scheme to control pollution and enhance the water quality in the degrade portion of the Delaware River Estuary. Water quality levels for three hypothetical management schemes were given. Estimation of Alosa sapidissima survival under these schemes was made. The authors constructed a mathematical model describing quantitative changes of a variable of concern to water quality management. This gave estimates of the water quality to be expected during an entire year for each of the three pollution control programs. Data were collected on the physiological responses of migrating shad in the Delaware River. This permitted determination of the relationship between DO and shad survival. These data were used in the decision process leading to the Delaware River management scheme. (Sjolseth-Washington)
W71-03058

ENZYMIC MECHANISMS OF TEMPERATURE COMPENSATION: IMMEDIATE AND EVOLUTIONARY EFFECTS OF TEMPERATURE ON ENZYMES OF AQUATIC POIKILOTHERMS,
British Columbia Univ., Vancouver. Dept. of Zoology.
George N. Somero.
The American Naturalist, Vol 103, No 933, p 517-530, 1969. 3 fig, 3 tab, 31 ref.

Descriptors: *Enzymes, *Animal metabolism, Fish physiology, *Animal physiology, *Biochemistry, Crabs, Shrimp, *Activation energy, Thermal stress, Compensation, Acclimatization.
Identifiers: *Aquatic poikilotherms, *Evolutionary effects, *Enzymic reactions, Eelpout, Lactate dehydrogenase, Pyruvate kinase, Temperature effects, *Michaelis constant, Adaptation, *Enzyme-substrate affinity.

The following conclusions have been drawn about temperature effects on enzymes of aquatic poikilotherms: (1) Immediate compensation to temperature changes is promoted by an inverse relationship between temperature and enzyme-substrate affinity. (2) The sharp decreases in enzyme-substrate affinity which frequently occur at the extremes of an organism's habitat temperature may be important in establishing thermal tolerance limits for the organism. (3) In evolutionary adaptation of enzymes to temperature, minimal Km values (maximal enzyme-substrate affinity) normally occur near the lower extreme of a species' adaptation temperature. However, evolutionary adaptation of enzymic rates does not appear to be effected by low absolute values of Km, and (4) Rate compensation to temperature, on an evolutionary time scale, is accomplished by activation energy changes, at least in the case of some enzymes. (Sjolseth-Washington)
W71-03060

MALATHION: CHRONIC EFFECTS ON ESTUARINE FISH,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
H. T. Holland, and Jack I. Lowe.
Mosquito News, Vol 26, No 3, p 383-385, September 1966. 5 ref.

Descriptors: Organophosphorus pesticides, Inhibition, Growth rates, Mortality, Enzymes, Pesticide toxicity, Fish physiology, Animal pathology.
Identifiers: *Malathion, Spot fish, *Leiostomus xanthurus, Brain cholinesterase, Enzyme activity, Recovery, Osmoregulation, Salinity tolerance.

Juvenile Leiostomus xanthurus were exposed to 10 ppb. malathion for 26 weeks. One group served as a control. Neither group of fish exhibited symptoms of distress nor did the two lots differ significantly in growth or mortality. Brain cholinesterase was significantly lower in the experimental group, stabilizing at approximately 70 percent of normal. This inhibition appeared to have no adverse effects on the fish. No differences in reactions between experimental and control groups when they were transferred from 2.8 percent salinity water to water of 1.5 percent salinity. There was no gross pathology of the gonads in the exposed fish. (Katz-Washington)
W71-03061

EFFECTS OF PROLONGED EXPOSURE TO SEVIN ON AN ESTUARINE FISH, LEIOSTOMUS XANTHURUS LACEPEDE,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
Jack I. Lowe.
Bulletin of Environmental Contamination and Toxicology, Vol 2, No 3, p 147-155, 1967. 8 ref.

Descriptors: *Carbamate pesticides, Pesticide toxicity, Bioassay, *Animal pathology, *Enzymes, Salinity, Growth rates, Mortality, Inhibition, Fish physiology.
Identifiers: *Sevin, *Leiostomus xanthurus, Spot fish, Osmoregulation, *Histopathology, Salinity tolerance, Central nervous system lesions, Enzyme activity, Brain chlorinesterase.

Leiostomus xanthurus were exposed to 0.1 ppm Sevin (a carbamate pesticide) for five months. Fish surviving this chronic exposure were examined histopathologically. Other survivors were subjected to drastic salinity changes to test their osmoregulatory ability. Mortality and growth rates in control and experimental were comparable. Chronically exposed fish showed some incidence of central nervous system lesions, although these could not be attributed to exposure to Sevin. No abnormal inhibition of brain cholinesterase was observed in the experimental group. Exposed and unexposed fish were subjected to rapid increases and decreases in salinity. No differences in reactions between exposed and unexposed fish were noticed. (Katz-Washington)
W71-03062

EMBRYONIC DEVELOPMENT OF THE PIKE (ESOX LUCIUS L.) WHEN INCUBATED UNDER DIFFERENT OXYGEN CONDITIONS,
Akademiya Nauk SSSR, Moscow. Inst. of Animal Morphology.
M. V. Gulidov.
Voprosy Ikhtiologii, Vol 9, No 6, p 841-851, 1969. 4 tab, 1 fig, 34 ref.

Descriptors: *Embryonic growth stage, Pikes, Incubation, Laboratory tests, *Oxygen requirements, Oxygenation, *Lethal limit, Water pollution effects, Dissolved oxygen, Mortality, Hatching, Viability, Fish eggs, Fishkill.
Identifiers: Oxygen conditions, *Threshold oxygen concentrations, Esox lucius, *Abnormal development.

Experimental data are presented on the effect of oxygen conditions on the development of the pike. Upper and lower threshold concentrations of oxygen are established. The lower threshold oxygen concentration is apparently 1.8 mg./l. The upper threshold oxygen concentration is between 39.5 and 45.3 mg./l. There is shown to be a pattern in the variation in mortality during incubation of the eggs and the number of individuals hatched when oxygen content is varied in the range between the upper and lower threshold concentration, and qualitative features of the development of the embryos are also established. (Sjolseth-Washington)
W71-03064

EFFECT OF OXYGEN ON GROWTH AND FOOD CONVERSION EFFICIENCY OF NORTHERN PIKE,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
Ira R. Adelman, and Lloyd L. Smith.
The Progressive Fish-Culturist, Vol 32, No 2, p 93-96, 1970. 2 tab, 3 figs, 5 refs.

Descriptors: *Dissolved oxygen, *Growth, *Food Conversion efficiency, Food consumption rates, *Northern pike, Temperature, Hydrogen Ion concentration, Length, Weight, Water pollution effects.
Identifiers: *Fathead minnows, MS-222.

Two laboratory experiments on Northern pike (Esox lucius) were conducted to determine the effect of varied oxygen concentrations on growth rate food consumption, and food conversion efficiency. An apparatus for rearing juvenile pike under various concentrations of dissolved oxygen was prepared. Pike were fed fathead minnows (Pimephales promelas) daily. Both experiments showed a gradual decrease in growth rate as the oxygen was reduced to 3 or 4 ppm and then a quick decrease below that level. (Wahtola-Washington)
W71-03089

EFFECTS OF THE INSECTICIDE SEVIN ON SURVIVAL AND GROWTH OF THE COCKLE CLAM CLINOCARDIUM NUTTALLI,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
Jerry A. Butler, Raymond E. Millemann, and Nelson E. Stewart.
U. S. PHS Grant No. CC 00303. Journal of the Fisheries Research Board of Canada, Col 25, No 8, p 1621-1635, 1968. 6 tab, 2 figs, 20 refs.

Descriptors: *Water pollution effects, *Insecticides, *Survival and growth, *Cockle clam, Sea water, Food consumption, Juvenile clams, Temperature.
Identifiers: *Sevin, *Mollusca, No 1-napthol, *Clinocardium nuttalli, *TLm's.

Experiments are reported on the effects of the insecticide, Sevin, and its hydrolytic product, 1-napthol, on the survival, growth, and food consumption of larval and juvenile cockle clams (Clinocardium nuttali). Clams were tested in standing sea water at a salinity of 25% and a temperature of 19 .. 2.0C, and were fed cultures of the unicellular alga Monochryis lutheri. Algal cell concentrations ranged from 10,000 to 200,000 cells per ml of test solution. Toxicant concentrations ranged from 0.1 to 10.0 mg/liter. Larvae exposed to Sevin concentrations of 0.8 mg/liter were dead by day 7 of the test, and the growth of those exposed to 0.4 mg/liter was reduced by 15%. The growth of juvenile clams was reduced more by 1-napthol than by Sevin. The food consumption of juvenile clams exposed to 1.6 mg/liter of Sevin was markedly reduced and their food conversion efficiency was impaired. Adult clams exposed to Sevin concentrated the toxicant in their tissues. Clams exposed at 11C concentrated more toxicant than those exposed at 20C. Tissue concentrations of toxicant decreased sharply after the clams had been in clean sea water for 12 hr. (Wahtola-Washington)
W71-03090

BEHAVIORAL RESPONSES TO ELECTROLYTES IN THE CRAYFISH, PROCAMBARUS CLARKII,
Texas Univ., Austin. Dept. of Zoology.
Mary W. Pocock, and James L. Larimer.
Physiological Zoology, Vol 41, No 3, p 332-340, 1968. 21 ref, 4 tab, 2 fig. NIH Grant NB-05423.

Descriptors: *Animal behavior, *Electrolytes, Crayfish, *Animal physiology, *Ions, Inhibition, Laboratory equipment, Sodium chloride, Potassium compounds, Calcium chloride, Magnesium compounds, Biochemistry, Ventilation, Water pollution effects.
Identifiers: Procambarus clarkii, *Responses, *Ion interaction, EKG, Lithium, Strontium, Barium, Acetates, *Heart response, Ion stimulation.

A behavioral test involving reflex cardiac and ventilation responses has been employed in indexing chemospecificity to electrolytes in the crayfish. 23 solutions, composed of various combinations of seven cations and five anions were tested on 33 animals. Ion stimulation did not in every case evoke reflex inhibition of both homolateral ventilation frequency and the heart. Solutions of divalent cations excite ventilation frequency, amplitude, or both; however, no pattern is discernible for the animals' heart responses. Monovalent cations inhibit ventilation, regardless of the anion present. A definite pattern of heart responses is seen to distinguish monovalent chlorides from monovalent nitrates. With chlorides, bilateral inhibition of ventilation is required in order to evoke the heart response. Monovalent nitrates evoke cardiac inhibition regardless of the heterolateral response. Preliminary results indicate the possibility of ion interaction in the form of an anesthetic effect of MgCl sub 2. Cationic versus anionic effects and the number of possible receptor sites have been discussed. (Katz-Washington)
W71-03091

TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE RELATION BETWEEN CONCENTATION AND IMMERSION TIME. STUDIES ON THE BIOLOGICAL ASSAY OF CHEMICALS IN FISHES (IN JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
V. Sumio Nagasawa, and Michiyo Shiba.
English Summary. Jap J Appl Ent Zool Vol 13, 47-51, 1969. 3 fig, 3 tab, 5 ref.

Descriptors: *Bioassay, Phenols, *Toxicity, *Regression analysis, *Statistics equations, Water pollution effects.
Identifiers: *PCP, Dojo fish, Misgurnus anguillicaudatus, Immersion time, Chi-square test.

Toxicity of PCP for the 'Dojo' fish, Misgurnus anguillicaudatus (Cantor), with special reference to the relation between concentration and immersion time. Studies on the biological assay of chemicals in fishes. In this paper, the toxicity of PCP-Na for the 'Dojo' fish was discussed through results obtained by a regression method, taking into consideration the immersion time of the fish and the concentrations of the testing solution. Immersion time in the testing solution was controlled by washing the whole test vial, including the fish, in running water. From the data of 87 combinations of concentrations (ppm) per weight (g) of fish C and time of immersion T (min.), together with indications of whether or not the fish responded, an equation for fitting a probit regression plan was estimated as: Y- — - 5.1725..3.3485xsub 1 ..5.6678xsub 2. Here x sub 1 and x sub 2 are log C and log T, respectively and Y is the probit probability of response P. Results of the X sq test showed no significant difference between the empirical probits and the predictions from the fitted equation. The 5% fiducial limit curves (t—1.96) for P—0.5 and 0.9 were calculated and were shown in the figures. (Katz-Washington)
W71-03092

TRANSPORT OF ORGANIC INSECTICIDES TO THE AQUATIC ENVIRONMENT,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 05B.
W71-03093

POLLUTION OF THE NORTH SEA AND REARING EXPERIMENTS ON MARINE PHYTOFLAGELLATES AS AN INDICATION OF RESULTANT TOXICITY,
H. Kayser.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 5 fig, 5 ref.

Descriptors: *Water pollution effects, Water pollution sources, Industrial wastes, Domestic wastes, Dinoflagellates, *Laboratory tests, Cultures, *Growth rates, Plant growth regulators, Plant growth substances, Algae, Iron, Bioassay, Bioindicators, Food chains, Titanium, Plant populations, Toxicity.
Identifiers: *North Sea, Prorocentrum micans, Ceratium furca, Turbidostat cultures.

The extreme pollution of the North Sea was described. Since this trend is likely to continue, the author developed methods for determination of the possible biological consequences. This method involves the culture of primary producers, namely dinoflagellates, in waste waters. Mass cultures provided information about the growth rate and maximum density of populations under the influence of waste water. This method is able to indicate the sublethal influences on characteristic members of the marine food chain. It is hoped that further advancement of the test method will allow calculation of the sublethal level of waste water discharge into the North Sea. (Sjolseth-Washington)
W71-03095

GENERAL LIMNOLOGICAL AND BIOLOGICAL STREAM SURVEYS AS A SIMPLE MEANS OF DETECTING POLLUTION AND CONTROLLING THEIR EFFECTS,
Landesstelle fuer Gewasserkunde, Karlsruhe (West Germany).
For primary bibliographic entry see Field 05A.
W71-03096

DEVELOPMENT OF A GROSS TOXICITY CRITERION IN SAN FRANCISCO BAY,
Engineering-Science, Inc., Arcadia, Calif.; and California Univ., Berkeley.
N. E. Armstrong, P. N. Storrs, and E. A. Pearson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 15 p, 10 fig, 1 tab, 14 ref.

Descriptors: Waste dilution, *Water quality act, *Bioassay, Lethal limit, Toxicity, *Water quality control, On-site investigations, On-site data collections, *Water quality, Biochemical oxygen demand, *Dispersion, Estuarine environment, Correlation analysis, Waste disposal, Mathematical models, California, Water pollution effects.

Identifiers: *San Francisco Bay, TLm, *Toxicity criteria, Benthic animal diversity.

The development is discussed of a relationship between the waste constituent, toxicity, and a measure (the diversity index) of the structure of a portion of the ecological community. These data would produce a rational approach for developing water pollution control design criteria which would protect the aquatic biota for desired uses. Methods for estimating the concentration of relative toxicity at any location in the receiving water were given. Correlation studies were conducted to develop cause and effect relationships between waste discharges and biological effects. The data indicated that damage will be done to the benthic fauna in those areas where the relative toxicity is not diluted to 40 ml./l or by a factor of 25, i.e., the water quality criterion that a waste discharge must receive a 25 to 1 dilution of its relative toxicity was established. (Sjolseth-Washington)
W71-03097

KINETICS OF PESTICIDES IN NATURAL MARSH ECOSYSTEMS,
Federal Water Pollution Control, Washington, D.C.
James O. Keith, Donald B. Knapp, and William C. Johnson.
Annual Progress Report, Bureau of Sports Fisheries and Wild Life, Wildlife Research Work Unit, Denver Wildlife Research Center, 1967. 48 p, 12 fig, 12 tab, 9 ref.

Descriptors: *Pesticide residues, Irrigation water, *Pesticide kinetics, Water pollution effects, *Freshwater marshes, Persistence, Oregon, Pesticide drift, *Pesticide toxicity, *On-site data collections, On-site investigations, Aquatic environment, *Water birds, Gulls, Gas chromatography, DDT, Dieldrin, Endrin, Aldrin, Waste analysis, Benthos, Aquatic populations.
Identifiers: Dursban, *Tule Lake, Grebes, Coots, Egrets, Terns, Chubs, DDD, DDE, Toxaphene, Heptachlor epoxide, Chlordane, Lindane, BHC, Kelthane, Thiodan, *Biomagnification.

Data on insecticide residues in birds and marsh habitats at Tule Lake Refuge between 1960 and 1967 were compiled. Results clearly show the seasonal impact on the marsh of contaminations in waste agricultural water, the biomagnification of residues, and the complex behavior and fate of insecticides in the marsh and in birds. Studies of Dursban persistence and effects in marsh habitats were investigated in Kern and Colusa Counties in 1967. Results are being prepared for publication. (Sjolseth-Washington)
W71-03098

THE EFFECT OF THREE COMMON POLLUTANTS ON THE RESPIRATION RATE OF TUBIFICID WORMS,
Eastern Illinois Univ., Charleston. Dept. of Zoology.
L. Stephen Whitley, and Richard A. Sikora.
Journal Water Pollution Control Federation, Part 2, p R57-R66, February 1970. 7 fig, 1 tab, 31 ref. NIH Grant No WP 00937-02.

Descriptors: Water pollution effects, *Respiration, *Tubificids, Sludge worms, *Phenols, Hydrogen ion concentration, Bioassay, Mortality, Toxicity, Animal metabolism, Industrail wastes.
Identifiers: *Nickel, *Lead, *Pentachlorophenol, *Respiration rate.

These data have shown the effects of lead, nickel, and pentachlorophenol to be regulated by the pH. The respiratory function of tubificids is affected very little by nickel, inhibited by lead, and stimulated by PCP. The lack of reaction to nickel concentrations would indicate little sensitivity to nickel inhibition of enzyme systems operating in tubificid respiration pathways. The effect of lead probably is due to mucous coagulation on the body wall inhibiting gaseous exchange. The effect of PCP of increasing respiration at higher pH levels would appear to be associated with its dual reaction of being considerably more toxic to pH levels below 8.5 and affecting respiration rate very little, and being less toxic at levels of 8.5 and higher and affecting respiration rate considerably. In each of the three experimental sets, however, the effect of an environmental factor, pH, on the relative effect of a pollutant is very clear. (Sjolseth-Washington)
W71-03099

THE DEVELOPMENT OF SOME BLACK SEA FISHES IN SEA WATER POLLUTED BY PETROLEUM PRODUCTS,
Akademiya Nauk URSR. Inst. of Biology of the Southern Seas.
O. G. Mironov.
Voprosy Ikhtiologii Vol 9, No 6, 919-922, 1969. 2 tab, 3 fig, 4 ref.

Descriptors: *Water pollution effects, *Oily water, Oil wastes, Fish eggs, Fishkill, Bioassay, Oil, Larval growth stage, *Mortality, Viability, Lethal limit.
Identifiers: *Oil pollution, Black Sea, Anchovy, Scorpion-fish, Sea-parrot, *Egg development stages, Petroleum, Black oil, Solar oil, *Survival, *Growth and development.

A study was made of the development of the fertilized eggs of Engraulis encrasicholus ponticus Alex., Scorpaena porcus L. and Crenilabrus tinca L. in sea water containing 0.1-0.001 ml/liter of petroleum, solar oil, and black oil. The different species sensitivity of the fishes to the petroleum products employed was clarified. A harmful effect of the substances selected (death of the organism) was clearly traced to a concentration of 0.001 ml/liter. It is suggested that lower concentrations of petroleum, solar oil and black oil will also be found to be toxic for the hydrobionts concerned. The consequences of such intoxication may not be revealed in the direct death of the eggs or prelarvae, but at later stages in development or in future generations. (Sjolseth-Washington)
W71-03100

MERCURY CONCENTRATIONS IN TISSUES OF FISH FROM THE SASKATCHEWAN RIVER,
Saskatchewan Univ., Saskatoon.
G. Wobeser, N. O. Nielsen, and R. H. Dunlop.
Journal Fisheries Research Board of Canada Vol 27, No 4, 830-834, 1970. 1 tab, 14 ref.

Descriptors: *Public health, Analytical techniques, *Heavy metals, Water pollution effects, Industrial wastes, Freshwater fish, On-site data collections, Suckers, Pikes.
Identifiers: *Mercury, Tissue analysis, *Saskatchewan River, Muscle tissue, Liver tissue, Kidney tissue, Canada.

Muscle tissue of 81 fish from several locations in the Saskatchewan River system contained an average of more than 1.0 ppm of mercury. Fish collected at two sites had much higher concentrations, with individual fish containing up to 11.2 ppm. The concentrations found were higher than those reported for fish from uncontaminated environments, and correspond to values reported for Scandinavian fish collected in areas of industrail pollution. (Sjolseth-Washington)
W71-03101

EFFECT OF RECENT ACIDIFICATION OF WATER ON THE PLANKTON ORGANISMS IN LAKE TOYA, HOKKAIDO (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Plankton Lab.
Teruyoshi Kawamura.
English summary. The Japanese Journal of Limnology Vol 30, No 3, p 87-97, October 1969. 10 ref, 4 fig, 3 tab.

Descriptors: Water pollution effects, *Hydrogen ion concentration, *Plankton, *Zooplankton, *Acidic water, Acid mine water, Scenedesmus, Daphnia, Photosynthesis, Environmental effects, Aquatic populations.
Identifiers: *Lake Toya, Hokkaido, Phytoplankton, *Cyclops, Population changes, Species abundance.

Since 1939, acidic water has penetrated into Toya Lake, resulting in the decrease in pH value of the lake water, as low as pH 5.8 near the surface in recent years. The species number of plankton organisms is extremely small in recent years. An experiment was made to ascertain an influence of acidification of water on the photosynthetic activity of phytoplankton, Scenedesmus sp. cultured in the laboratory. Carbon fourteen technique was adopted to estimate photosynthesis on the experimental waters of three kinds of pH value under 1-10 klux of light intensity. In the control water (pH 7.4) photosynthesis is as high as 15 mgC/m cu/h at the optimum light intensity of 6 klux, whereas in the water of pH 5.8 which mixed acidified lake water with pond water the rate is extremely low, being 2.5 mgC/m cu/h in the optimum light intensity (4-10 klux). Experiments on the survival of two species of zooplankton, Cyclops strenuus and Daphnia pulex, in waters of various grades of pH value were made. In waters below pH 5.0 all Daphnia died within four days. In pH 6.0 water the surviving number of Daphnia was 40% of a total of individuals on the fourth day. In contrast to the above fact, all Cyclops experimented upon survived in the water of pH 5.0 for four days. Successions in the leading species of zooplankton clearly correspond to the progress of acidification of lake water. (Katz-Washington)
W71-03102

ANAEROBIC SURVIVAL OF THE CRUSTACEANS COROPHIUM VOLUTATOR, C. ARENARIUM AND TANAIS CHEVREUXI,
University Coll. of North Wales, Menai Bridge. Marine Science Lab.
J. C. Gamble.
Journal of the Marine Biological Association UK, Vol 50, p 657-671, 1970. 7 tab, 3 fig, 37 ref.

Descriptors: Anaerobic survival, Crustaceans, Amphipods, Temperature, Survival peracaridean, Water pollution effects.
Identifiers: LT50, Corophium volutator, C. arenarium, Tanais chevreuxi.

An investigation of the anaerobic survival capacities of the amphipods Corophium volutator (Pallas), C. arenarium Crawford and the peracaridean Tanais chevreuxi Dollfus shows that all are relatively resistant to anaerobic conditions. All three species survive for longer periods at lower temperatures. In Corophium small individuals are shown to be less resistant to anaerobic conditions than large. T. chevreuxi is considerably more resistant than either Corophium species, while C. volutator is slightly more so than C. arenarium. It is suggested that the high resistance of T. chevreuxi is due to its semi-sessile crevice dwelling existence and that of the Corophium species, when compared with other amphipods, is an effect of their tubiculous habits in almost anoxic substrata. (Wahtola-Washington)
W71-03103

FACTORS AFFECTING PESTICIDE-INDUCED TOXICITY IN AN ESTUARINE FISH,
Bureau of Sport Fisheries and Wildlife, Highlands, N.J. Sandy Hook Marine Lab.
Ronald Eisler.
Bureau of Sport Fisheries and Wildlife Technical Paper No 45, 1970. 20 p, 11 fig, 3 tab, 23 ref.

Descriptors: *Pesticide toxicity, *Bioassay, *Mortality, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, Degradation, Water temperature, Hydrogen ion concentration, Salinity, Endrin, Aldrin, Dieldrin, Heptachlor, DDT, Lethal limit, Water pollution effects, Estuarine environment.
Identifiers: Fundulus heteroclitus, Lindane, Methoxychlor, Malathion, DDVP, Methyl parathion, Phosdrin, Dioxathion, *Toxicity factors, Postexposure mortality, *Recommendations.

Factors affecting mortality caused by insecticides in the mummichog, Fundulus heteroclitus, include duration of exposure, concentration and class of chemical, degradation or alteration of experimental compounds in seawater, and temperature, alinity, and pH of the medium. Static bioassays with organochlorine (endrin, aldrin, dieldrin, heptachlor, p,p'-DDT, lindane, methoxychlor) and organophosphorus (malathion, DDVP, methyl parathion, Phosdrin, dioxathion) insecticides were conducted. Heptachlor, Phosdrin, methyl parathion, and lindane were 4.6 to 12.5 times as toxic to mummichogs at 240 hours as at 96 hours. In holding studies, mortality was high during a 240-hour observation period following 96-hour exposure. The toxicity of organophosphorus insecticides to mummichogs was directly proportional to temperature between 10 and 30C. and to salinity between 12% and 36% and inversely proportional to pH in the range 5.5 to 10. Toxicity of organochlorine insecticides to mummichogs was greatest at intermediate temperatures (20-25C.) and least at intermediate pH 97-8) within the ranges tested. Salinity of the medium had little or no measurable effect on toxicity. (Sjolseth-Washington)
W71-03104

ACUTE TOXICITIES OF ORGANOCHLORINE AND ORGANOPHOSPHORUS INSECTICIDES TO ESTUARINE FISHES,
Bureau of Sport Fisheries and Wildlife, Highlands, N.J. Sandy Hook Marine Lab.
Ronald Eisler.
Bureau of Sport Fisheries and Wildlife Technical Paper No 46, 1970. 11 p, 10 tab, 23 ref.

Descriptors: *Bioassay, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, Toxicity, Lethal limit, *Mortality, Endrin, DDT, Dieldrin, Aldrin, Heptachlor, Eels, Killfishes, *Pesticide toxicity, Water pollution effects.
Identifiers: Dioaxathion, Lindane, Methoxychlor, DDVP, Methyl parathion, *Estuarine fish, Fundulus heteroclitus, Atlantic silversides, Relative toxicity, Northern puffer.

Static 96-hour bioassays with 12 insecticides and seven species of estuarine teleosts (Anguilla rostrata, Fundulus heteroclitus, Fundulus majalis, Thalassoma bifasciatum, Mugil cephalus, Menidia menidia, Spaeroides maculatus) were conducted. Endrin was consistently the most toxic and methyl parathion consistently the least toxic compound tested. The descending order of insecticide toxicity to fishes at 96 hours was endrin, p,p'-DDT, dieldrin, aldrin, dioxathion, heptachlor, lindane, methoxychlor, Phosdrin, malathion, DDVP, and methyl parathion. LC50 values ranged from 0.05 to 3.1 ppb active ingredients with endrin, 0.4 to 89 ppb with p,p'-DDT, 0.9 to 34 ppb with dieldrin, 6 to 75 ppb with dioxathion, 0.8 to 194 ppb with heptachlor, 9 to 66 ppb with lindane, 12 to 150 ppb with methoxychlor, 65 to 800 ppb with Phosdrin, 27 to 3,250 ppb with malathion, 225 to 2,680 ppb with DDVP, and 5,200 to 75,800 ppb with methyl parathion. (Sjolseth-Washington)
W71-03105

FURTHER INVESTIGATIONS OF THE EFFECT OF DDT ON LEARNING IN FISH,
Fisheries Research Board of Canada, St. Andrews (New Brunswick).
D. A. Jackson, J. M. Anderson, and D. R. Gardner.
Canadian Journal of Zoology, Vol 48, No 3, p 577-580, 1970. 3 tab, 1 fig, 2 ref.

Descriptors: *DDT, *Fish behavior, Brook trout, Inhibition, Atlantic salmon, Laboratory tests, Laboratory equipment, Water pollution effects.
Identifiers: *Avoidance response, Conditional response, Learning.

Atlantic salmon parr and brook trout were treated with sublethal doses (20 to 1000 ppb) of DDT and then were subjected to training procedures for avoidance conditioning. A modified shuttlebox was used as the conditioning apparatus and the conditioning stimulus consisted of a light change. Of 16 parr and 21 brook trout treated with sublethal doses of DDT, only one (trout) failed to learn the avoidance response by 100 trials. The results indicate that sublethal doses of DDT do not per se affect learning, but that the effects produced by DDT can significantly alter the ability of the fish to perform the tasks involved. (McConnell-Washington)
W71-03106

ESTUARINE WATER QUALITY AND BIOLOGIC POPULATION INDICES,
California Univ., Berkeley.
P. N. Storrs, E. A. Pearson, H. F. Ludwig, R. Walsh, and E. J. Stann.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 10 p, 2 tab, 4 fig, 14 ref.

Descriptors: Estuarine environment, Water quality, Surveys, On-site investigations, On-site data collections, *Water pollution effects, *Bottom sediments, Coliforms, Aquatic populations, *Benthic fauna, Oligochaetes, Regression analysis, Sulfides, Ammonia, Nitrogen.
Identifiers: *San Francisco Bay, *Aquatic ecology, *Population indices, *Species diversity.

Quantitative methods are given for measuring the relationships between water quality and aquatic ecology. Benthic animal diversity was used as a tool for assessing the adverse effects of pollution. Sediment samples were collected at 49 sampling locations throughout San Francisco Bay and analyzed for benthic animals. Changes in the species diversity index are related to levels of waste constituents in the sediments. It was shown that high sediment concentrations of sulfide and a high index of putrescibility were associated with decreased benthic animal diversity. The authors found no significant decrease in the concentrations of ammonia or nitrate nitrogen and coliform bacteria between locations having high or low benthic animal diversity. (McConnell-Washington)
W71-03107

TOXIC EFFECTS OF HYDROGEN SULFIDE TO JUVENILE FISH AND FISH EGGS,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
Lloyd L. Smith, Jr., and Donavon M. Oseid.
25th Industrial Waste Conference, Purdue, May 6, 1970. Typescript. Paper No 7278, Scientific Journal Series, Minnesota Agr Exp Sta. 7 p, 1 fig, 6 tab, 5 ref.

Descriptors: Water pollution effects, *Hydrogen sulfide, *Fish eggs, Fish toxins, Domestic wastes, Industrial wastes, Water pollution sources, *Bioassay, *Toxicity, Incubation, Embryonic growth stage, Laboratory tests, Walleye, Rainbow trout, Pikes, Suckers, Dissolved oxygen, Lethal limit, Hatching, Viability, Evaluation.
Identifiers: Soil water interface, *Embryonic deformity, *Water quality standards, Sunfishes.

A series of bioassays were conducted with hydrogen sulfide on eggs and fry of walleye pike, rainbow trout, white suckers, and northern pike and on juvenile and adult fathead minnows, bluegills, and walleyes. Various dissolved oxygen levels were used. Fry of the four test species were much more sensitive to hydrogen sulfide than their eggs. In adult and juvenile minnows, bluegills and walleyes the range of tolerance to H2S was small. Maximum range of levels which permitted 100 percent survival and no survival was from 0.016 to 0.035 ppm in bluegills and the minimum was 0.016 to 0.021 ppm in walleyes. Eggs exposed to H2S produced the highest number of deformed embryos. Lowered dissolved oxygen levels increases the toxicity of H2S. The authors conclude that the use of 96 hour TLm values for the setting of safe standards for fish life will not be adequate. Longer exposures must be made. (Sjolseth-Washington)
W71-03108

THE EFFECTS OF DIELDRIN ON DIATOMS,
Kansas Univ., Lawrence. Dept. of Zoology.
John Cairns, Jr.
Mosquito News, Vol 28, p 172-179, 1968. 1 tab, 1 fig, 6 ref. USPHS Grant EF-00266.

Descriptors: *Dieldrin, *Diatoms, Laboratory tests, Insecticides, Water pollution effects, Algae.
Identifiers: *Effects, Navicula seminulum var.Hustedtii.

The effects of Dieldrin on Navicula seminulum was described. At a dieldrin concentration of 12.8 ppm the number of diatoms was only half that in the controls at the end of the 5-day growth period. There was no increase in the number of cells at 32.0 ppm, and a concentration of 1.8 ppm was only 10.6 percent different from the controls. (Wahtola-Washington)
W71-03183

A MODIFIED VERSION OF THE BLAZKA RESPIROMETER AND EXERCISE CHAMBER FOR LARGE FISH,
Washington Univ., Seattle. Fisheries Research Inst.
Lynwood S. Smith, and Timothy W. Newcomb.
Journal of the Fisheries Research Board of Canada, Vol 27, p 1321-1324, 1970. 2 fig, 6 ref.

Descriptors: *Respirometer, *Exercise chamber, *Equipment, Fish, Fish physiology.
Identifiers: *Blazka respirometer modification.

A modified version of the Blazka Respirometer and Exercise Chamber for large fish was described. A tube-within-a-tube respirometer has been built in which a jet outboard impeller propels the water. A towline attached to the fish through its dorsal musculature to keep it out of the pump avoids the electrolysis problems of an electric grid when using sea water. (Wahtola-Washington)
W71-03184

EFFECTS OF THE INSECTICIDE SEVIN ON VARIOUS STAGES OF THE DUNGENESS CRAB, CANCER MAGISTER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
David V. Buchanan, Raymond E. Millemann, and Nelson E. Stewart.
Journal of Fisheries Research Board of Canada, Vol 27, p 93-104, 1970. 3 tab, 4 fig, 14 ref.

Descriptors: Water pollution effects, *Carbamate pesticides, Crabs, *Hatching, *Pesticide toxicity, Resistance, Larval, *Lethal limit, Bioassay, Growth rates, Animal behavior, Pesticide residues, Insecticide.
Identifiers: *Sevin, *Dungeness crab, *Molting, Zoeae, Life history stages, Paralysis, Sensitivity.

Of the life-history stages of the Dungeness crab the early larvae are more sensitive to Sevin than are juvenile and adults. A concentration of 1.0 mg/liter did not affect egg hatching but prevented molting of all prezoeae to zoeae. The concentration that killed 50% of the first stage zoeae during a 96-hour exposure was estimated to be 0.01 mg/liter. Few zoeae were killed in 24 hr. by 82.0 mg/liter, but the 24-hr EC50 for death within 15 days after the exposure was estimated to be 0.015 mg/liter. Survival of zoeae after 25 days exposure to concentrations of 0.0001, 0.00032, 0.001, 0.0032, and 0.01 mg/liter were 83,60,69, 21 and 0%, respectively, and control survival was 79%. The 24-hr EC50's for death or irreversible paralysis were estimated to be 0.076 and 0.35 to 0.62 mg/liter for second and ninth stage juveniles, respectively. The 24-hr and 96-hr EC50's for death or irreversible paralysis were 0.49 and 0.26 mg/liter, respectively, for adult crabs. The significance of these findings in field application of Sevin to control oyster pests and predators is discussed. (Sjolseth-Washington)
W71-03185

COMPARATIVE EFFECTS OF ABS AND LAS ON THE MOSQUITO MINNOW (GAMBUSIA AFFINIS),
Prairie View Agricultural and Mechanical Coll., Tex.
Thomas P. Dooley.
The Texas Journal of Science, Vol XX, No 2, p 147-155, 1968. 4 fig, 3 tab, 5 ref.

Descriptors: Water pollution effects, *Alkylbenzene sulfonate, *Linear alkylate sulfonates, *Bioassay, Toxicity, Fishkill, Mortality, *Lethal limit, Resistance, Animal pathology, Fish physiology, *Detergents, Fish behavior.
Identifiers: Mosquitofish, *Gambusia affinis, *Gill damage, *Histological examination.

Mosquito minnows (Gambusia affinis) exposed to 0.1% solutions of ABS and LAS were killed within 7 minutes. The survival time increased as the fish were exposed to lower concentrations. Fish reached the cut-off point in LAS at a higher concentration than ABS. This shows ABS to be more toxic than LAS. Four to 9-week old fish succombed in a shorter period of time than older ones. Females consistently withstood concentrations that were lethal to males. The gills of fish killed by ABS and LAS showed severe damage and in many cases only the skeletal portion of the gills remained. (Sjolseth-Washington)
W71-03186

TOXICITY OF PCP FOR THE 'DOJO' FISH, MISGURUNUS ANGUILLICAUDATUS (CANTOR), WITH SPECIAL REFERENCE TO THE SIZE OF FISHES (IN JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
For primary bibliographic entry see Field 05A.
W71-03188

TOLERANCE OF MYSIS RELICTA TO THERMAL SHOCK AND LIGHT,
National Water Quality Lab., Duluth, Minn.
Wesley E. Smith.
Transactions of American Fisheries Society, Vol 99, No 2, p 418-422, 1970. 7 fig, 9 ref.

Descriptors: Laboratory tests, Water pollution effects, Thermal pollution, *Thermal stress, *Light intensity, Mortality, *Acclimatization, Bioassay, Lethal limit, Fish food organisms.
Identifiers: Thermal tolerance, *Mysis relicta, Light tolerance, Survival.

Tests were conducted to determine the thermal tolerance and effects of laboratory illumination on survival of Mysis relicta. Mysids were affected adversely by heat stress when temperatures rose above 10C. When acclimated to a temperature of 7.5C., this species had 96-hour median tolerance limits of 16 to 16.5C. Percent mortality was essentially the same when the animals were subjected immediately to test temperatures, as when temperatures were raised gradually from acclimation temperature over a period of 5 hours. When acclimated to a temperature of 4.5C. and then subjected to temperature elevations of 1, 2.5, and 5C per day, 50% of the animals died at 16C in 16 days, 18C in 6 days and 16C in 4 days, respectively. It is suggested the Mysis relicta is an organism requiring considerable time for effective acclimation. Mysids were intolerant of exposure to normal laboratory illumination. The species lived satisfactorily in light of 10 hours a day for 2 weeks, but this period was followed by a steady mortality of about 8% of the original population per week. (Sjolseth-Washington)
W71-03189

UNITED STATES V FLORIDA POWER AND LIGHT CO (THERMAL POLLUTION OF BISCAYNE BAY).
For primary bibliographic entry see Field 06E.
W71-03260

5D. Waste Treatment Processes

THE TREATMENT OF DISPERSE TEXTILE DYE WASTES BY FOAM FRACTIONATION,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
Donald L. Michelsen, and Thomas B. Fansler.
Available from NTIS as PB-196 313, $3.00 in paper copy, $0.95 in micofiche. Water Resources Research Center Bulletin No. 34, 1970. 99p, 22 tab, 17 fig, 176 ref, 2 append. OWRR Project A-017-VA (2).

Descriptors: Waste water treatment, *Foam fractionation, *Flocculation, *Textiles, Industrial wastes, Chemical oxygen demand.
Identifiers: *Dye wastes.

Laboratory foam fractionation and limited jar flocculation investigations were conducted to determine how effective foam fractionation was for the treatment of textile dispersed dye wastes and the chemical costs for such a treatment. The results indicate that cationic surfactants at about 50 ppm concentration can be used as a foaming aid to remove 52.1 percent of the COD, 89.2 percent of the color, and 75.3 percent of the turbidity from a simulated dye bath waste containing 300 ppm dye and 200 ppm dispersing agent (sodium lignosulfonate). The chemical cost would be about $210 per day to treat 1.0 MGD. Actual dilute wastes respond similarly but would be costly to treat since surfactant concentration would be 10 to 25 ppm. On the other hand, flocculation with 100 ppm alum removed 70 percent COD, 75 percent color, and 82 percent turbidity from a dilute discharge (about 1/10 of the simulated waste). Treatment cost would be $55 per MGD. (See also W71-02833)
W71-02832

TREATMENT OF DYEING BATH WASTES STREAMS BY FOAMING AND FLOTATION TECHNIQUES,
Virginia Polytechnic Inst., Blacksburg. Water Resources Research Center.
D. L. Michelsen.
Project Completion Report, December 1970. 7 p, 5 ref. OWRR Project No A-017-VA (1).

Descriptors: Waste water treatment, *Foam fractionation, *Flocculation, *Textiles, Industrial wastes, Chemical oxygen demand.
Identifiers: *Dye wastes.

Laboratory foam fractionation and limited jar flocculation investigations were conducted to determine how effective foam fractionation was for the treatment of textile dispersed dye wastes and the chemical costs for treatment. (See also W70-02832)
W71-02833

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: ANALYSIS OF WATER SUPPLY AND SEWERAGE FACILITIES OF MERCER COUNTY.
Mercer County Planning Board, Trenton, N.J.

Available from NTIS as PB-193 974, $3.00 in paper copy, $0.95 in microfiche. HUD No. NJ P-96. Final Report No 7, November 1969. 41 p, 7 tab, 2 map, 19 ref.
Identifiers: (*Regional planning, *New Jersey), (*Water resources, Regional planning), (*Sewers, Regional planning), Waste water, Waste treatment, *Mercer County (New Jersey), *Waste treatment facilities.

Approximately 266,000 of Mercer County's 300,000 population is supplied with water from public or private water sources. The remainder receives its water from individual private wells. The source of water for 75 percent of the County is the Delaware River and the Water is supplied by the city of Trenton Water Company. The analysis indicates that the County has adequate water resources to handle expected future development. Most of Mercer County's population is serviced by modern waste water collection and treatment facilities. For the remainder of the County, preliminary engineering reports and feasibility studies are studies are being prepared by municipal officials and study groups to indicate how these areas can be serviced.
W71-02834

OZONATION, NEXT STEP TO WATER PURIFICATION,
R. J. Bender.
Power, Vol 114, No 8, p 58-60, Aug 1970. 3 p, 4 fig.

Descriptors: *Ozone, *Water purification, *Water treatment, Oxidation, Costs, Sewage treatment, Sewage effluents, *Potable water, Purification, Viruses, Bacteria, *Waste water treatment, Water analysis, Concentration.
Identifiers: Bacteria control.

Ozone is a superior oxidizing agent that helps clean water more thoroughly. Ozone as a purifier is used mostly in preparing municipal potable water, and was used in Nice, France, as early as 1906. Ozonation does not replace the chlorination process. Ozone kills bacteria and viruses completely, but does not affect water taste; the slight chlorine taste introduced during preliminary treatment is eliminated. Ozonated water is completely limpid. In the U S the trend is toward ozonation of waste water and treatment of sewage effluent before release into waterways. Ozone concentrations of 0.1 ppm maintained at the exit completely disinfect sewage effluents. (USBR)
W71-02848

IRON REMOVAL USING MAGNESIUM OXIDE,
Illinois Univ., Urbana. Dept. of Civil Engineering.
John T. O'Connor, and Barrett E. Benson.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7740, p 1335-1348, December 1970. 14 p, 8 ref, append.

Descriptors: *Waste water treatment, *Chemical precipitation, *Iron, *Groundwater, *Magnesium compounds, Oxygenation, Sanitary engineering, Filtration, Flocculation, Alkalinity, Aeration.
Identifiers: *Iron removal.

The calcined magnesite-diatomaceous earth process is currently being used for the removal of iron from groundwater supplies. However, information from controlled laboratory studies describing the mechanism of the reaction and the kinetics of iron removal has been lacking. The addition of finely divided MgO in dry form to waters of various pH reactions and alkalinities results in the gradual solution of MgO with approximately 3/4 dissolving in 10 minutes. Laboratory studies indicate that the rate of solution is not strongly influenced by the initial pH. Ferrous iron precipitation is incomplete within 10 minutes unless abundant oxygen is present, indicating that MgO accelerates the oxygenation of ferrous iron. Some adsorption of ferrous iron occurs on the MgO particle in the absence of oxygen. This appears to lower the rate of MgO solution. It is hypothesized that the gradual solution of MgO results in the formation of diffuse regions of high pH around the MgO particle surface where iron oxidation is greatly accelerated. (Woodard-USGS)
W71-02904

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05B.
W71-02953

ADSORPTION OF PESTICIDES BY CLAY MINERALS,
Missouri Univ., Rolla. Dept. of Civil Engineering.
J-Chang Huang, and Cheng-Sun Liao.

Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA 5, p 1057-1078, October 1970. 4 tab, 21 fig, 12 ref. OWRR Project A-016-Mo (3).

Descriptors: *DDT, *Dieldrin, *Hepta-chlor, *Adsorption, *Clays, Environmental engineering, Equilibrium, Mechanisms, Pesticides, Rates, Sanitary engineering, Water pollution.

The rate and equilibrium of adsorptions of DDT, dieldrin, and hepta-chlor by illite, kaolinite, and montmorillonite from aqueous pesticidal solutions are evaluated using the batch technique under laboratory conditions. The adsorption of each of these three pesticides at an initial concentration of 100 ug/l by kaolinite and illite is nearly instantaneous, with the molecules of pesticides being deposited on the clays' surfaces. As montmorillonite is an expansible clay, DDT and heptachlor are not only able to concentrate on the clay's surface but can diffuse gradually into the clay's interlamellar spaces. The adsorptive capacity of each clay is not related to its ion exchange capacities or specific surface area, yet dependent upon a specific pesticide-clay combination. The adsorption of DDT and heptachlor is relatively irreversible; however, a certain extent of dieldrin desorption occurs. It is concluded that the primary mechanisms of the adsorption of these pesticides by clays are through the formation of hydrogen bondings and some other string forces of interaction. Only in the case of dieldrin do the van der Vaals forces contribute to a significant extent to the overall adsorption reaction.
W71-02980

INDUSTRIAL BY-PRODUCT RECOVERY BY DESALINATION TECHNIQUES.
Aqua-Chem, Inc., Waukesha, Wis.
For primary bibliographic entry see Field 03A.
W71-03004

REVERSE OSMOSIS FIELD TESTING ON ACID MINE WATERS AT NORTON, WEST VIRGINIA,
Gulf General Atomic, Inc., San Diego, Calif.
S. S. Kremen, A. B. Riedinger, J. H. Sleigh, and R. L. Truby.
For saly by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price: $0.50. Office of Saline Water Research and Development Progress Report No 586, July 1970. 44 p, 13 tab, 5 fig, 2 ref, append. OSW Contract 14-01-0001-1836.

Descriptors: *Reverse osmosis, *Mine drainage, *Mine wastes, Osmosis, *Demineralization, *Acid mine water, West Virginia, Membranes, *Membrane processes, Waste water treatment.
Identifiers: Norton (W Va).

The objective of the program was to gain knowledge of the demineralization of acid mine drainage by reverse osmosis (RO). A 10K gpd RO unit equipped with eighteen 50 sq ft modules was employed for this work. Tests were conducted to compare high-selectivity modules with high-flux modules and 600 psi operation with 800 psi operation, and to investigate additional operation at recoveries higher than 75%. In addition, a small RO unit was used to compare GGA high-flux perchlorate membrane with commercail high-flux formamide membrane. The high-flux, 50 sq ft modules exhibited comparable rejection and a substantial increase in flux relative to the high-selectivity modules. Operation at 800 psi resulted in no loss in rejection as compared with 600 psi operation; however, the effect of the increased pressure on flux remains unclear. Operation at feedwater recoveries up to 92% was achieved. High-flux perchlorate membrane displayed flux decline and rejection comparable to those of the commercial high-flux formamide membrane. Experimentation on flux restoration through chemical treatment of the modules proved successful. A parametric study was conducted to determine the projected operation costs of 1-, 10-, and 50-million-gpd RO units. The results of this study are presented in the appendix. (Lew-Office of Saline Water)
W71-03005

DEVELOPMENT OF TUBULAR REVERSE OSMOSIS MODULE ASSEMBLY TECHNIQUES,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 03A.
W71-03006

REMOVAL OF LIGNIN BY FOAM SEPARATION PROCESSES,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
Thomas E. Wilson, and M. H. Wang.
Available from NTIS as PB-196 478, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute, Rutgers - the State University of New Jersey, New Brunswick, N.J., November 1970. 13 p, 4 tab, 3 fig, 14 ref. OWRR Project A-022-NJ (2).

Descriptors: *Foam fractionation, *Waste Treatment, Water pollution treatment, Water pollution, *Waste water treatment, Lignins, Ion exchange, Separation techniques, Foam separation.
Identifiers: *Ion floatation.

A laboratory investigation into foam separation processes led to largely negative results for most pollutants. However, effective removal of lignin, an important waste constituent of Kraft process paper mills, was achieved by means of the ion floatation process. Removal was from 90 to 98% effective (on a color basis) depending on conditions. (Whipple-Rutgers)
W71-03011

A COMPARISON OF EXPANDED-BED AND PACKED-BED ADSORPTION SYSTEMS,
FMC Corp., San Diego, Calif. Ordnance Engineering Div.
Charles B. Hopkins, Walter J. Weber, Jr., and Ralph Bloom, Jr.
Available from NTIS as PB-187 756, $3.00 in paper copy, $0.95 in microfiche. FWQA Robert A. Taft, Water Research Center, Advanced Waste Treatment Laboratory-II, Report No. TWRC-2, Dec 1968, p 1-74. 9 tab, 35 fig, 9 ref. FWQA Project 17020-12/68, Contract No 14-12-76.

Descriptors: *Adsorption, *Activated Carbon, Effluent, Filters, Waste water treatment.
Identifiers: *Packed Beds, *Expanded Beds, Clarification, Chemical Treatment.

The program evaluated with pilot scale adsorbers under actual filter conditions, the feasibility of the expanded-bed technique for contacting granular activated carbon with biologically treated sewage effluent, providing a comparison with the conventional packed-bed operation. The packed-bed and expanded-bed adsorption systems, operating under comparable conditions, were found essentially equivalent in their effectiveness for removal of soluble organic material from a secondary sewage effluent. Suspended solids were more effectively removed by the packed beds. Accumulation of suspended solids caused rapid increase in head loss in the packed beds, necessitating frequent cleaning of the carbon in these beds. Suspended material accumulated on individual carbon granules in the expanded beds creating larger particles of decreased density. Because the expanded beds are not subject to clogging from accumulated solids, their pumping power and maintenance requirements are lower than for a packed bed of the same size. Where the improved suspended solids removal provided by a packed bed is not required, the expanded-bed adsorber may be preferred. (Selby-Texas)
W71-03018

COST OF WASTE WATER TREATMENT PROCESSES,
Dorr-Oliver, Inc., Stamford, Conn.
David DiGregorio.
Available from NTIS as PB-187 760, $3.00 in paper copy, $0.95 in microfiche. Federal Water Pollution Control Administration, FWQA Robert A. Taft Water Research Center Report No. TWRC-6, Dec 1968. 53 p, 34 fig, 5 ref, 4 tab. Project No 17010--12168, Contract No 14-12-60.

Descriptors: *Cost, *Waste Water Treatment, Activated sludge, Trickling filters, Sludge treatment, Sludge disposal.
Identifiers: Sales, Profit, Labor, Materials.

New capital cost information for conventional and some advanced waste water treatment processes has been collected and correlated in terms of capacity and size. Operating costs have been calculated for some of the processes. Conventional processes considered include comminution, grit removal, primary settling, biological treatment of activated sludge and trickling filter, final settling, and sludge treatment and disposal. Advanced processes include phosphate extraction, chemical clarification, and sand filtration, carbon adsorption, and membrane ultrafiltration. An extensive survey of Dorr-Oliver, Inc., sales information yielded a large volume of data relating equipment costs to loading and equipment size. Costs, including profit and installation, were updated by applying factors derived from known equipment price increases. Construction costs, including material, labor, profit, engineer's and contractor's fees, were estimated from company experience and updated. The information provided is concerned only with the unit process under consideration. No effort was made to evaluate the cost of land, excavation or inter-process requirements. The method of lease squares was used to correlate the generated data. In many cases the data could be described by a straight line, Y—aX..b, on an arithmetic or logarithmic plot. Where this description was not satisfactory, an equation of the form Y—1/aX..b was used. A computer program was written to facilitate the lease square computations. (Selby-Texas)
W71-03020

ELECTROKINETIC PHENOMENA IN THE FILTRATION OF ALGAL SUSPENSIONS,
Cornell, Howland, Hayes and Merryfield, Seattle, Wash.; and Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
Gerald W. Foess, and Jack A. Borchardt.
Journal American Water Works Association, Vol 61, p 333-338, 1969. 10 fig, 1 tab, 18 ref.

Descriptors: *Algae, *Sands, *Filtration, Filters, Electrophoresis, Chlorella, Scenedesmus, Adsorption, Sewage treatment, Particle size.
Identifiers: *Algal suspensions, Electrokinetic effects, Ann Arbor (Mich), Sand beds.

This investigation revealed that the attachment mechanism for discrete algae in sand filtration involves a surface affinity between the algal cells and sand grains, an interaction which can be chemically controlled. A lowering of the suspension pH value increases adsorption of the particles and thereby significantly augments the removal of suspended matter. The removal is also increased due to a reduction of the repulsive energy of sand by its coating with positively charged substances. These modifications of sand and suspended particle properties promise to increase filter removal efficiencies beyond those possible with normal doses of coagulants and with minimal head loss buildup. (Wilde-Wisconsin)
W71-03035

ON THE PROBLEM OF UNIFIED ANALYTICAL DETERMINATION OF VAPORIZABLE MONO- AND POLYPHENOLIC COMPOUNDS

IN GERMAN INVESTIGATIONS OF WATER, WASTE WATER, AND SLUDGE (IN GERMAN),
Martin-Luther-Universitaet, Halle-Wittenberg (East Germany).
Horst Thielemann.
Zeitschrift fur Chemie, Vol 9, No 10, p 390-391, 1969. 1 tab.

Descriptors: *Phenols, *Effluents, *Waste identification, Analytical techniques, Sludge, Taste.
Identifiers: Bromination analysis, Halle (Germany), Cresol, Resorcinol, Hydroquinone, Pyrogallol, Chlorophenol.

The bromination method for determination of phenolic compounds in waste waters and industrial effluents is neither well standardized nor always most advantageous. One of the shortcomings of the method is that the liberation of bromine from the potassium bromide-potassium bromate mixture is accompanied by a rise in temperature. This requires an addition of ice which influences the pH of the titrated solution and the amount of excess bromine. The results also vary depending on the period of bromination. According to the results of analyses of waste waters of Halle (Germany), 1 hour is the most desirable time for bromination. The calculation of vaporizable phenols is based on the assumption that the mean molecular weight is 102. (Wilde-Wisconsin)
W71-03047

PUBLIC SERVICE AND FACILITIES ELEMENT: SEWAGE DISPOSAL, THE CITY OF ANDERSON GENERAL PLAN.
Hahn, Wise and Associates, Inc., San Carlos, Calif.

Available from NTIS as PB-189 869, $3.00 in paper copy, $0.95 in microfiche. January 1970. 16 p.

Descriptors: California.
Identifiers: *Urban planning, *Sanitary engineering, Management planning, Reviews, Records, Sewage, Environment, Urban areas, Analysis, Mapping, Costs, *Anderson (California), Public facilities.

The report covers the following: A review of existing reports and records related to the City's sewerage system: study of environmental conditions and their influence in relation to present and prospective uses of sewerage facilities; an analysis of the existing sewerage facilities to include location of trunk sewers and lift stations; the preparation of maps, charts, diagrams, and drawings showing the essential features of the recommended improvements; and the preparation of cost estimates for the recommended improvements.
W71-03082

AEROBIC AND ANAEROBIC LANDFILL STABILIZATION PROCESS,
Stone (Ralph) and Co., Los Angeles, Calif.
Ralph Stone, and Rishab K. Gupta.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7766, p 1399-1414, December 1970. 16 p, 12 fig, 1 tab, 14 ref, append.

Descriptors: *Landfills, *Aerobic conditions, *Anaerobic conditions, *Stabilization, Laboratory tests, Land reclamation, Sanitary engineering, Solid wastes, Bacteria, Biochemistry, Microorganisms, Decomposing organic matter, Aeration, Garbage dumps, Oxygen demand, Model studies.
Identifiers: *Sanitary land fills.

A series of laboratory investigations was performed to simulate the aerobic and anaerobic sanitary landfill environment. The oxygen demand of solid waste was found to be directly proportional to the amount of easily utilizable organic material present. Bread media had a higher rate of oxygen consumption than did grass or paper media. Media containing several types of solid waste showed even higher oxygen demand than that of the bread media. Under anaerobic conditions, methane production was greater in readily decomposable organic material (garbage) than in a typical cellulose waste. An aerated landfill was found to harbor many kinds of aerobic thermophilic microbes; bacteria were always predominant. Some pure culture bacteria grew at 160 deg-180 deg F. All thermophilic microbes were not cellulolytic. Purified cellulose fibers were degraded by various aerobic microbes in pure culture. (Woodard-USGS)
W71-03121

A STUDY OF WASTEWATER IRRIGATION THROUGH COMPUTER SIMULATION,
Bauer Engineering, Inc., Chicago, Ill.
Kenneth J. Cypra, Wayne Cowlishaw, and William J. Bauer.
Water Resources Bulletin Vol 6, No 6, p 935-943, November-December 1970. 9 p, 4 fig, 2 tab, 3 ref.
EPA-WQO Grant 11010 FMY.

Descriptors: *Simulation analysis, *Water reuse, *Waste water disposal, *Irrigation water, Sewage effluents, Michigan, Mathematical models, Systems analysis, Computer programs, Water storage, Waste treatment, Lagoons.
Identifiers: *Wastewater irrigation, *Muskegon (Mich).

Muskegon, Michigan, typical of a medium-sized Northern urban area, is currently adopting wastewater irrigation to meet its present and future wastewater treatment needs. Design of a system for Muskegon, Michigan must consider, among other things, the quantity of storage needed prior to irrigation and the quality of water in the storage lagoons. A computer-simulated operation of the storage and irrigation aspects of the proposed wastewater irrigation system resulted in a better understanding of storage requirements and critical quality parameters (particularly anaerobic conditions during spring break-up). Results are depicted in terms of maximum storage requirements and in terms of average monthly outflow. Maximum storage requirements occur in April and May before the start-up of spring irrigation. Maximum wastewater irrigation occurs April to July with the peak varying according to the irrigation rate. Quality values are generally independent of the rates of irrigation. The BOD level within the storage lagoons is estimated to range from about 12 to 43 mg/liter, with DO levels ranging from 0 to about 8 mg/liter. The simulation program is written in FORTRAN IV for acceptance by the GE Mark I series computer. (Knapp-USGS)
W71-03126

ECONOMICS OF CANNERY WASTE TREATMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
D. E. Evenson, and G. T. Orlob.
Water and Sewage Works, Vol 117, No 3, p IW/17-IW/21, March 1970. 2 fig, 2 tab.

Descriptors: *Canneries, *Dynamic programming, *Waste water treatment, *Decision making, Waste treatment, Aerobic treatment, Biological treatment, Industrial wastes, Water pollution control, Water pollution abatement, Water pollution sources, Project planning, Planning, Abatement, Economics, Optimization, Cost analysis.
Identifiers: *Cannery wastes.

In this study the method of dynamic programming was used to investigate the economics of cannery waste treatment. Liquid waste streams were characterized by their BOD, and solids generated in treatment were characterized by their volume. For the problem studied, it was found that a system consisting of screening an aerated lagoon, and depending on plant size, either composting or land fill disposal of solids was most economical. Minimum cost-size-efficiency relationships were used to evaluate the alternatives between treating the wastes in-plant, discharging to a municipal system or combinations of the two. The study neglects possible economies through changes in the canning processes; only waste treatment alternatives are considered. Techniques to analyze the entire waste problem require further development. More research is necessary to obtain information relating treatment efficiency to plant size and cost, and to determine the relationship between liquid waste treatment and solids generation. (Hewett-Rutgers)
W71-03219

5E. Ultimate Disposal of Wastes

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN MADISON, WISCONSIN,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05B.
W71-02825

DISPERSAL OF PLATING WASTES AND SEWAGE CONTAMINANTS IN GROUNDWATER AND SURFACE WATER, SOUTH FARMINGDALE - MASSAPEQUA AREA, NASSAU COUNTY, NEW YORK,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02922

BRINE DISPOSAL POND MANUAL,
Bureau of Reclamation, Denver, Colo. Engineering Research Center.
Maurice E. Day.
For Sale by Supt. of Documents U.S. Government Printing Office Washington, D.C. 20402. Price $1.25. Office of Saline Water Research and Development Progress Report No 588, August 1970. 134 p, 6 tab, 17 fig, 5 append. OSW Contract 14-01-0001-1306, Work Order No 3.

Descriptors: *Brine Disposal, *Desalination, *Ponds, Costs, Disposal, Waste water disposal, Waste disposal, *Linings.
Identifiers: Design criteria, *Solar ponds, *Disposal ponds, Inland desalting plants.

This manual covers the design and construction of brine disposal ponds for use in disposing of waste brine from inland desalting plants. Specific design criteria are presented for a hypothetical brine disposal pond system based on data from the vicinity of Roswell, New Mexico. Estimates of the cost of various sizes of multiple pond systems are made based on the design criteria assumed for the Roswell site. Operation and maintenance requirements which affect the planning of a brine disposal system are included. The manual presents data on various linings considered suitable for ponds and gives construction information for lining installation. A summary of the regulations of various states with respect to ponding is included as an appendix. (Gransee-Office of Saline Water)
W71-02950

PUBLIC SERVICE AND FACILITIES ELEMENT: SEWAGE DISPOSAL, THE CITY OF ANDERSON GENERAL PLAN.
Hahn, Wise and Associates, Inc., San Carlos, Calif.
For primary bibliographic entry see Field 05D.
W71-03082

MARINE DISPOSAL OF SOLID WASTES,
Public Health Service, Cincinnati, Ohio.
Charles G. Gunnerson, Robert P. Brown, and David D. Smith.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7769, p 1387-1397, December 1970. 11 p, 5 fig, 2 tab, 16 ref.

Descriptors: *Solid wastes, *Disposal, *Oceans, Water pollution sources, Sanitary engineering, Ecology, Legal aspects, Planning, Regulation, Data collections.

Identifiers: *Refuse disposal, Offshore disposal sites.

In 1968, approximately 48,000,000 tons of wastes from the civilian sector were disposed in the United States coastal waters at an estimated cost of $29,000,000 by tug and barge operations. All indications point to increasing amounts in the future. There are critical needs for baseline environmental data, adequate monitoring systems, and establishment of responsibility for regulating discharges of solid or containerized wastes at sea. Many agencies have responsibilities that bear on the marine disposal of solid wastes. The most troublesome factor is the lack of jurisdiction on the seas beyond the 3-mile limit or on the bottom beyond the Continental Shelf. (Woodard-USGS)
W71-03120

SYSTEMS ANALYSIS OF BRINE DISPOSAL FROM REVERSE OSMOSIS PLANTS,
Dow Chemical Co., Midland, Mich.
P. G. LeGros, C. E. Gustafson, B. P. Shepherd, and W. F. McIlhenny.
For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: $1.75. Research and Development Progress Report No 587, August 1970. 202 p, 57 tab, 69 fig, 49 ref. OSW Contract 14-01-0001-2252.

Descriptors: *Brine disposal, Ponds, *Desalination, Deep wells, Pretreatment, Intakes, *Costs, *Systems analysis, Osmosis.
Identifiers: Geologic considerations, *Reverse osmosis, Design criteria, Solar ponds, Cost estimates, Meteorological considerations, Inland desalting.

Reverse osmosis desalting systems were analyzed for six inland locations to determine the effects of disposal methods on total system cost. Communities were selected which would represent a range of feedwater types, evaporation rates and underground geology. The six communities were Minot, N. D.; Arkansas City, Kansas; Clinton, Oklahoma; Midland, Texas; Gallup, New Mexico; and Fort Morgan, Colorado. The desalting system was divided into its functional components: feedwater acquisition, pretreatment, reverse osmosis, waste preconditioning and waste disposal. Engineering designs were prepared and costs estimated for the intake, source well, disposal well and evaporation pond elements at several levels of flow rate. Unit costs were derived for the various elements for plant recovery rates from 0.5 to 0.98. For the six case communities the most economical operating recovery factors ranged between 0.9 and 0.98. Product water unit costs of the several functional components were combined to give the total system cost. Lowest total system unit costs for the 1 MGD capacity system ranged from $0.84 to $1.19 per 1000 gallons of fresh water. (Gransee-Office of Saline Water)
W71-03216

5F. Water Treatment and Quality Alteration

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: ANALYSIS OF WATER SUPPLY AND SEWERAGE FACILITIES OF MERCER COUNTY.
Mercer County Planning Board, Trenton, N.J.
For primary bibliographic entry see Field 05D.
W71-02834

OZONATION, NEXT STEP TO WATER PURIFICATION,
For primary bibliographic entry see Field 05D.
W71-02848

REMOVAL OF COLOR FROM THE WATER OF WAIKOLOA STREAM, SOUTH KOHALA DISTRICT, ISLAND OF HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
Nathan C. Burbank, Jr., Po Lau Chan, and Reginald H. F. Young.
Available from NTIS as PB-196 359, $3.00 in paper copy, $0.95 in microfiche. Hawaii University Water Resources Research Center Technical Report No 38, March 1970. 21 p, 10 fig, 1 tab, 5 ref. OWRR Project A-999-HI (5).

Descriptors: *Color reactions, *Analytical techniques, *Water treatment, *Water quality, *Hawaii, Streams, Colorimetry, Color, Water analysis, Coagulation, Colloids, Zeta potential, Catalysts, Cation adsorption.
Identifiers: *Water color removal, Alum sulfate, Ferric sulfate, Cationic polyelectrolyte.

The colored bodies in the water of the Waikoloa Stream (Hawaii) are predominantly organic in origin with the color colloid having a negative charge. The color of the water varies from a maximum value of 320 units to a minimum value of 22 units. The average value is about 80 units. The zeta potential of the color colloid has varied from negative 36 mv to negative 18.5 mv. It was possible to remove color to the U. S. Public Health Service standards for interstate carriers by coagulating the color bodies with either alum or ferric sulfate. Cationic polyelectrolyte aids reduced the quantity of the coagulant required to effect color removal; decreased the required retention time in the flocculation basin; and caused a faster rate of sedimentation. The most satisfactory coagulant aid is a cationic polymer, which not only acts as an aid but also as a true coagulant in color removal. Reductions by as much as 20% in the amount of primary coagulant required is possible while obtaining the same results. The optimum pH range is 6 to 7 and the optimum dosage of cationic polymer is from 1 to 3 mg/l in conjunction with 15 to 20 mg/l coagulant. (Woodard-USGS)
W71-02884

THE EFFECTS OF COPPER SULFATE ON CERTAIN ALGAE AND ZOOPLANKTERS IN WINNISQUAM LAKE, NEW HAMPSHIRE,
New Hampshire Univ., Durham. Water Resources Research Center.
Philip J. Sawyer.
Available from NTIS as PB-196 481, $3.00 in paper copy, $0.95 in microfiche. New Hampshire Water Resources Research Center, WRR-2, 1970. 28 p, 2 fig, 5 tab, 17 ref. OWRR Project A-004-NH (4).

Descriptors: *Copper sulfate, *Algae, *Zooplankters, *Chemcontrol, New Hampshire, Copepods, Daphnia, Sampling, Depth, Cyanophyta, Chrysophyta, Chlorophyta, Primary productivity, Carbon radioisotopes, Photosynthesis.
Identifiers: *Winnisquam Lake (N H), Anabaena circinalis, Bosmina longirostris, Synura uvella, Dinobryon, Oscillatoria limnetica, Dictyosphaerium, Cell counts, Fragilaria, Asterionella, Cryptomonas, Sphaerocystis, Daphnia galeata mendotae, Daphnia magna.

In a relatively unbuffered lake such as Winnisquam, control of cyanophycean bloom can be accomplished with relatively small amounts of copper sulfate --4 lbs/acre. Data on 27 algal species present before, during, and after addition of copper sulfate indicate that a rapid shift in species relationships occurred. Carbon fixation rate was found to be a more sensitive measure of bloom potential than cell counts. Susceptible species decreased in numbers; other forms increased in population; some appeared unaffected by treatment. The latter group may have been protected by natural resistance or by their position in the water column. Zooplankton reacted to copper treatment in various ways. The effects on microcrustaceans such as copepods and daphnids seemed to follow a predictable pattern. Copepods and Bosmina longirostris were more resistant than Daphnia. Bosmina multiplied to a concentration of 154/liter in the top meter of the water column. The rise and fall of specie numbers of plants and animals and their rapid response to conditions after copper sulfate treatment illustrate their complex relationships. The crude treatment with copper sulfate did produce control of an obnoxious blue-green alga, Anabaena circinalis. (Jones-Wisconsin)
W71-03014

UTILIZATION OF ALKOXYSILANES FOR REDUCTION OF THE ABUNDANCE OF PHYTOPLANKTON DURING 'BLOOMS' OF WATER BASINS (IN RUSSIAN),
Moscow State Univ. (USSR).
N. S. Stroganov, V. G. Khobotiev, L. V. Kolosova, and M. A. Kadina.
Doklady Akademii nauk SSSR, Vol 181, No 5, p 1257-1259, 1968. 2 fig, 2 tab, 13 ref.

Descriptors: *Herbicides, *Algae, Toxicity, Scenedesmus, Chlorella, Daphnia, Deterioration, Water treatment, Degradation (Decomposition).
Identifiers: *Algal blooms, *Organo-silicates, *Alkoxysilanes, Scenedesmus quadricauda, Chlorella vulgaris, Daphnia magna, Limnaea stagnalis, Ouspenskii's medium.

A search for herbicides suppressing algal blooms, but harmless to zooplankters and other hydrobionts lead to investigation of organo-silicates: venyltriethoxysilane, tetraethoxysilane, and trifluoropropenyl- (methyl)-diethoxysilane. The test organisims included Scenedesmus quadricaude, Chlorella vulgaris, Daphnia magna, and Limnaea stagnalis. The count of survived specimens showed that the concentration of 0.01 mg/liter of all investigated compounds eliminated 93% to 96% of algal cells without damaging either daphnia or mollusks. Among the advantages of the alkoxysilanes is their relatively rapid disintegration in water. (Wilde-Wisconsin)
W71-03056

ACTIVATED GRANULAR CARBON FILTRATION - SOME ASPECTS TO CONSIDER,
Westvaco Corp., Covington, Va. Chemical Div.
A. Y. Hyndshaw.
Journal of the New England Water Works Association, Vol 84, No 2, p 105-126, June 1970. 10 fig.

Descriptors: *Activated carbon, *Adsorption, *Water purification, *Water treatment, Carbon, Filters, Design, Sanitary engineering.
Identifiers: *Granular activated carbon, *Powdered activated carbon, Dechlorination.

This paper begins with a brief discussion of the history and mechanism of activated granular carbon filtration in water treatment. Procedures are given for the estimation of carbon dosage and column configurations based on experimental studies. The relative economy of powdered and granulated carbon systems is discussed in relation to factors such as relative carbon dosage, chlorine replacement, carbon attrition loss in granular systems, possible savings in back wash water with certain granular carbon systems, possible regeneration of granular carbon, and the higher dechlorination capacity of granular carbon. Areas in which present knowledge is limited and further study is necessary are mentioned. It is concluded that in treatment plants requiring low dosages of powdered carbon, powdered carbon is more economical than granular carbon, but that granular carbon may be advantageous where high powdered carbon dosages are used, or where superchlorination is practiced. Furthermore, it is concluded that pilot plant studies are impractical where powdered carbon dosages less than 2 ppm are required, because of the extremely long test periods necessary. (Hewett-Rutgers)
W71-03223

5G. Water Quality Control

FLOW CONCENTRATION GROINS FOR REAERATION IN PASSAIC RIVER - A HYDRAULIC MODEL STUDY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
E. L. Bourodimes, and L. Michna.
Available from NTIS as PB-196 476, $3.00 in paper copy, $0.95 in microfiche. Water Resources Scientific Information Center, Department of the Interior, Washington, DC 20240. Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, September 1970. 99 p, 16 tab, 22 fig, 27 ref. A-023-NJ (1).

Descriptors: *Hydraulic design, *Hydraulic engineering, *Water quality control, Hydraulics, Turbulence, New Jersey, Hydraulic models, *Reaeration aeration, Flow rates.
Identifiers: *Instream aeration, Surface aerators, *Passaic River (NJ), Flow concentration, Flow velocity.

For the purpose of reaeration of polluted rivers, a mechanical surface aeration device was tested by the Water Resources Research Institute of Rutgers University. At low flows the aerator has a tendency to recirculate the same once-aerated water within the basin. The flow concentration devices are proposed to be used with the mechanical aerator to increase the streamflow velocity and the level of stream turbulence along the approach to the aerator. This should diminish recirculation of the water due to higher velocities, and enhance the level of turbulence. This investigation reports on the hydraulic model of the proposed flow concentration devices performance in relation to the mean flow velocity and turbulence characteristics and measurements. Some of the important conclusions are: (1) The determination of hydrodynamic aspects of flow discharge, velocity distribution and turbulence characteristics of the model tested are in fair agreement with existing results. (2) It was clearly demonstrated that the technique of stream flow concentration devices provides marked increase of mean velocities along the center line of the channel. (Whipple-Rutgers)
W71-03009

LAKE EUTROPHICATION--WATER POLLUTION CAUSES, EFFECTS AND CONTROL.
Minnesota Univ., Minneapolis. Water Resources Research Center.

Available from NTIS as PB-196 479, $3.00 in paper copy, $0.95 in microfiche. 'Save the Lakes Symposium' held at Detroit Lakes, Minnesota, August 18-19, 1969. Water Resources Research Center, University of Minnesota, Minneapolis, Bulletin No 22, 1970. 61 p. OWRR Project A-999-MINN (13).

Descriptors: *Eutrophication, *Lakes, *Water pollution, Minnesota, Water quality, Nutrients, Sediments, Coliforms, Municipal wastes, Agriculture, Fallout, Drainage, Management, Wisconsin, Productivity, Algae, Economics, Political aspects, Geology, Topography, Groundwater, Biochemical oxygen demand, Phosphorus, Fish, Weeds, Cycles, Bacteria, Chemistry, Physics, Stratification, Biological treatment, Viruses, Cyanophyta, Legislation, Chemcontrol.
Identifiers: Detroit Lakes (Minn), Community action, Lake Sallie (Minn), Lake Melissa (Minn), Nutrient removal.

Papers presented at 'Save the Lakes Symposium' held at Detroit Lakes, Minnesota, August 18-19, 1969, focused on lake pollution and eutrophication: what it is, what causes it, the technology needed and available to control it, and the type of community action that can and must be taken for effective control and improvement. The purpose is to make facts available to the public and to clarify the cooperative role of citizens and government. The life cycle of a lake is described. Improved methods of lake management may be uncovered in fundamental studies dealing with present sources of pollution, municipal sewage and diffuse sources, such as agricultural operations, fallout and washout from air, drainage, and the technical problems involved. The history and diversion of wastes at Madison, Wisconsin, Lake Tahoe and Lake Washington is described. Besides the scientific areas, the major problems are lack of political leadership necessary for proper evaluation of water quality and providing financing necessary for solution. The geological history of the Detroit Lakes is given. There are many means of alleviating eutrophication: ecological control, biological control, chemical control, and mechanical control. (Jones-Wisconsin)
W71-03012

STUDIES ON THE INTERACTIONS OF AQUATIC BACTERIA AND AQUATIC NEMATODES,
Auburn Univ., Ala. Water Resources Research Inst.
Gerald R. Wilt, and Roger E. Smith.
Available from NTIS as PB-196 480, $3.00 in paper copy, $0.95 in microfiche. Alabama Water Resources Research Institute Bulletin 701, 1970. 67 p, 58 fig, 12 tab, 25 ref. OWRR Project A-006-ALA (1).

Descriptors: *Aquatic bacteria, *Nematodes, Pseudomonas, Mud, Bottom sediments, Nutrients, Ammonia, Toxicity, Temperature, Yeasts, Molds, Organic matter, Worms, Thermal pollution, Sampling, Reservoirs, Farm ponds, Fish hatcheries, Rivers, Streams, Fungi, Alabama, Salmonella, Enzymes, Aquatic populations, Food chains.
Identifiers: *Inland waters, *Bacteria-nematode association.

Interactions of aquatic bacteria and aquatic nematodes were investigated to determine number and kinds of bacteria found in aquatic nematodes throughout Alabama, the effect of various bacterial metabolites on certain aquatic nematodes, and effect of various nematode products on growth of bacteria isolated from them. A total of 1842 potential bacterial-feeding nematodes from bottom mud samples were surfaced, cleansed, crushed, and the residue cultured for associative bacteria of 15 genera. In determining suitability of bacteria as sole nutrient, nematodes showed growth and reproduction in a wide range of bacterial cell concentrations. 23 of 25 bacterial isolates tested, provided all substances necessary for development of a nematode population in monoxenic cultures. Assay nematodes responded differently when fed the same species of bacteria suggesting differences in bacteria suitability as nematode nutrient. In vitro studies showed nematodes could locate a food base placed at a distance. Certain bacteria produce nematocidal metabolites which could serve as biological control agents of certain nematodes. Chromobacterium produced two volatile toxic substances--cyanide and ammonia. Increased temperature, where bacterial cells and nematodes are growing, may cause otherwise nutritious bacteria to become toxic. (Jones-Wisconsin)
W71-03013

PROCESS CONTROL MODEL FOR OXYGEN REGENERATION OF POLLUTED STREAMS,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
Burton Davidson, and J. V. Hunter.
Available from NTIS as PB-196 482, $3.00 in paper copy, $0.95 in microfiche. Research Project Technical Completion Report, Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, Mar 1970. OWRR, Project B-011-NJ (1).

Descriptors: *Optimization, Water pollution, Water quality, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: Optimal Control Theory, Lumped and distributed parameter systems, Organic carbon.

The objectives of the project were divided into experimental and theoretical parts. In the experimental part (part I), the objective was to correlate rapidly determined parameters (i. e. chemical oxygen demand, organic carbon and ammonia) with 5-day BOD using linear regression analysis on samples taken from the Passaic River in New Jersey. Equations were developed for the prediction of the 5-day BOD -20C- (dilution technique), the 5-day 20C BOD (Warburg technique), and the 20-day 20C BOD (Warburg technique) from the ammonia, organic carbon, and chemical oxygen demand concentrations. The resulting equations indicated that only somewhere between 40% and 80% of BOD variations were reflected by the concentrations of the parameters. Although the reason for this is not too clear, it does indicate that the predictions of biological oxygen consumption from a knowledge of the concentrations of chemical oxygen are dubious and their use in a control system rather hazardous. In the theoretical part (part II), the objective was to provide control models for simulating staged instream aerators based on experimental data taken from the Passaic River instream aeration project. The models were computerized on an analog computer for use in obtaining oxygen-uptake rates and parameter values. As part of the theoretical investigations (part III), the optimal instream aeration problem was formulated and analyzed in terms of Pontryagin's Minimum Principle. (Davidson-Rutgers)
W71-03015

BIOGEOCHEMICAL MODELING OF EUTROPHIC LAKES FOR WATER QUALITY IMPROVEMENT,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
M. W. Tenney, W. F. Echelberger, Jr., P. C. Singer, F. H. Verhoff, and W. A. Garvey.
Fifth International Conference on Water Pollution Research, San Francisco, California, July 26-August 1, 1970. Preprint. 22 p, 4 fig, 2 tab, 17 ref.

Descriptors: *Systems analysis, *Water quality, *Eutrophication, *Mathematical models, Simulation, Analytical techniques, Phosphorus, Algae, Lakes, Microorganisms, Tertiary treatment, Effluents, Model studies.
Identifiers: Heterotrophs, Autotrophs.

A mathematical simulation of biogeochemical exchanges in a lake system and its use in synthesising the eutrophication history are described. Taken as a single-stage, continuous-flowing reactor system with variable inputs and outputs, general trends are predictable. The concentration of organic carbon and phosphorus determine the extent of heterotrophic and autotrophic activity in the model, and the resultant activity is measured as suspended solids. Internal exchanges between state and location of pollutants is characterized by rate functions, and when necessary, a stochiometry of each of the bio- and physical reactions is included. A deterministic simulation model was applied to Stone Lake, Cassopolis, Michigan, and reasonable predictions were made with regard to organic material, inorganic phosphorus, and suspended microorganisms. The model is applicable to prediction of future water quality and certain manipulation procedures to enhance water quality. Ecological modeling developments will assist political decisions leading to development of successful concepts in water quality management. (Auen-Wisconsin)
W71-03021

A TWO-YEAR STUDY OF BACTERIAL POPULATIONS IN INDIANA FARM POND WATERS,
Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
L. B. Hughes, and H. W. Reuszer.
Indiana Academy of Science, Vol 79, p 423-431, 1970. 3 fig, 4 tab, 7 ref. OWRR Project A-005-IND (15).

Descriptors: *Bacteria, *Indiana, *Farm ponds, Sampling, Surfaces, Depth, Seasonal, Temperature, Organic matter, Turbidity, Hydrogen ion concentration, Nitrates.

The changes were determined in numbers of bacteria in farm pond waters and some factors possibly influencing bacterial numbers were investigated. A 2-year study of bacterial populations in farm pond waters was conducted on three farm ponds at the Southern Indiana Purdue Agricultural Center. Samples of water from the surface and near the bottom were taken approximately once each month; bacterial numbers were determined by colony counts. Great differences in bacterial numbers were found between ponds, and large seasonal variations in bacterial numbers were found within ponds. Maximum numbers occurred in late spring or early summer in all three ponds. Consistently higher numbers of bacteria were present in Pond C and lowest numbers in Pond B. Water temperatures were quite similar in all three ponds, although a significant correlation between water temperature and bacterial numbers was found only in Pond C. Organic carbon content was consistently highest in Pond C and lowest in Pond B. Significant positive correlation coefficients between organic carbon and bacterial numbers were found in Ponds A and B, but a significant negative correlation was found in Pond C. (Jones-Wisconsin)
W71-03023

AUTOECOLOGICAL AND SAPROBIOLOGICAL INVESTIGATIONS OF FRESH WATER CILIATES (IN GERMAN),
Bonn Univ. (Germany). Zoological Inst.
Hartmut Bick.
English summary. Hydrobiologia, Vol 31, No 1, p 17-36, 1968. 13 ref.

Descriptors: *Indicators, *Protozoa, *Environment, *Organic matter, Water quality, Temperature, Hydrogen ion concentration, Oxygen, Carbon dioxide, Ammonia, Nitrites, Hydrogen sulfide, Salinity, Lakes, Nutrients, Bacteria, Algae, Brackish water, Alkaline water, Sodium.
Identifiers: *Ciliates, Flagellates, Saprobien system, Ciliate autoecology.

Ecological valencies of 31 sp of fresh water ciliates are presented in tabulated form. Environmental factors include temperture, pH, oxygen, carbon dioxide, free and bound ammonia, nitrites, hydrogen sulfide, and the total concentration of salts in brackish waters and inland alkaline lakes enriched in sodium. This record is supplemented by a number of bacteria, accompanying different ciliates. As far as possible, the optimum ranges of site factors are given for different species. The autoecological results are related to the indicator value of species for the Saprobien System of monitoring water quality. (Wilde-Wisconsin)
W71-03031

EVALUATING INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences; and Rutgers Univ., New Brunswick, N.J. Water Resources Research Inst.
Joseph V. Hunter, and William Whipple, Jr.
Journal Water Pollution Control Federation, Vol 42, No 8, Part 2, p R249-R262, 1970. 8 fig, 2 tab, 10 ref. FWQA Project No 16080 DUP, OWRR Project B-010 NJ, B-011 NJ, and B-022 NJ.

Descriptors: *Water quality control, *Streams, *Aeration, *Dissolved oxygen, Waste treatment, Oxygenation, Decomposing organic matter, Systems analysis, Biochemical oxygen demand, Stochastic proscesses, Mathematical models, Simulation analysis, Flow measurements, Model studies.
Identifiers: Aerators, Oxygen transfer rates, Mass balance analysis, Passaic River (NJ), Benthal respirometer.

Observations of full scale aerators on a small polluted river confirmed the economy of instream aeration for rivers in which secondary treatments of wastes do not achieve desired dissolved oxygen levels. Electrically driven aerator provided 50% greater efficiency of oxygen transfer at the highest discharge of about 1.0 cfs. The photosynthetic reoxygenation, benthal decomposition, and deoxygenation were investigated by using dark-light bottles, benthal respirometer, and determination of oxidized forms of nitrogen. The parameters obtained were applied to mathematical modeling and the process of dynamic simulation was used with a TR-48 analog computer. The difficulties of excessive aeration were avoided by analysis of biochemical oxygen demand mass balance. (Wilde-Wisconsin)
W71-03038

REAERATION MEASUREMENTS IN A EUTROPHIC STREAM,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Wilber A. Blain, and Archie J. McDonnell.
Reprinted from the Proceedings of the 22nd Industrial Waste Conference, Purdue University, May 1967. Pennsylvania State University, Institute for Research on Land and Water Resources, University Park, Reprint Series No 1, p 1044-1058, 1967. 7 fig, 5 tab, 13 ref, 2 append. A-003-PA (2).

Descriptors: *Mathematical studies, *Dissolved oxygen, *Reaeration, Correlation analysis, Equations, Temperature, Biochemical oxygen demand, Streams, Respiration, Benthos, Analysis.
Identifiers: *Reaeration coefficient, O'Connor-Dobbins equation, Isotropic turbulence formula, Spring Creek (Pa).

Reaeration rate studies were conducted in a small eutrophic stream. Dissolved oxygen and temperature were continuously recorded to obtain estimates of the reaeration coefficient. The determined coefficients were compared with values from prediction formulae. The analyses of night dissolved oxygen-time data provided a method for establishing reaeration coefficient in streams in which accurate estimates of spatial oxygen consumption is difficult. Most accurate predicted value of the coefficient were obtained with O'Conner-Dobbins equation. (Wilde-Wisconsin)
W71-03046

QUANTITATIVE ESTIMATION OF MIGRATORY FISH SURVIVAL UNDER ALTERNATIVE WATER QUALITY CONTROL PROGRAMS,
Federal Water Quality Administration, Edison, N.J.
For primary bibliographic entry see Field 05C.
W71-03058

SYSTEM ECONOMIC RESPONSE TO WATER QUANTITY AND QUALITY - FUNDAMENTAL CONSIDERATIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 06B.
W71-03067

MATHEMATICAL MODELING OF GULF COAST ESTUARIES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Roy W. Hann, Jr.
Water Resources Bulletin, Vol 6, No 3, p 323-338, May-June 1970. 16 p, 9 fig, 2 tab. FWPCA R and D Grant 16090DQW.

Descriptors: *Computer models, *Analytical techniques, *Estuaries, *Mathematical models, *Water quality control, *Systems analysis, Pollution, Streamflow, Dissolved oxygen, Texas.
Identifiers: Gulf Coast, Steady-state models, San Bernard River.

An outline is presented of the dominant characteristics which affect the properties of the Gulf Coast estuaries including geography, tide and current effects, wind effects, salinity and density regime, nature and level of waste discharges, low inflow levels, dredging effects and present quality levels. Two basic levels of analytical modeling which are useful in water quality management were presented. The first was a relatively crude completely mixed estuarine model which permitted economical evaluation of varying parameters. The streamflow analysis was made on the San Bernard Estuary and a total of over 2000 separate analyses were made under a variety of system conditions to provide sufficient answers for trends to be analyzed and displayed. The second model was a very general steady state model which permitted analysis of stratified systems. It was a segmentized finite difference model and calculated steady-state distribution of organic wastes and other materials with a defined decay function and resulted in a dissolved oxygen profile for combinations of waste loads to the sytem. The ESTPOL computer language designed to simplify the use of the steady state model was described. The practical use of the analytical models as management tools for the solution of Texas Estuarine quality problems was demonstrated. (Kriss-Cornell)
W71-03074

DEVELOPMENT OF A GROSS TOXICITY CRITERION IN SAN FRANCISCO BAY,
Engineering-Science, Inc., Arcadia, Calif.; and California Univ., Berkeley.
For primary bibliographic entry see Field 05C.
W71-03097

MARINE DISPOSAL OF SOLID WASTES,
Public Health Service, Cincinnati, Ohio.
For primary bibliographic entry see Field 05E.
W71-03120

EVALUATING INSTREAM AERATION OF POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
J. V. Hunter, and W. Whipple.
Journal Water Pollution Control Federation, Part 2, Vol 42, No 8, p R249-R262, August 1970. Federal Water Quality Administration Program 16080 DUP.

Descriptors: *Aeration, *Oxygenation, *Water pollution control, *Dissolved oxygen, *Systems analysis, Biochemical oxygen demand, Optimization, River flow, Stochastic processes.
Identifiers: *BOD mass balance, *Instream aeration.

The paper gives results of operation of full-scale aerators on a small polluted river under carefully controlled conditions, and of the analytical methods found applicable. The results confirm the economy of instream aerators for non-tidal rivers, where secondary treatment of wastes is not sufficient to achieve desired D.O. levels. The oxygen uptake rates of the aerators were reduced to standard conditions, for comparability with other methods. The systems analysis of the basin was conducted by means of a BOD mass balance analysis, having consideration for observed benthal and photosynthetic effects. Considerations of water quality variability indicate that a stochastic basis for water quality standards should be utilized. (Whipple-Rutgers)
W71-03224

IN-STREAM AERATION: AN ALTERNATIVE TO ADVANCED WASTE TREATMENT,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Civil Engineering - ASCE, September 1970, p 78-80.

Descriptors: *Aeration oxygenation, *Water pollution control, *Dissolved oxygen, *Systems analysis, *Biochemical oxygen demand, *Water quality control, Optimization, River flow, Stochastic analysis.

dentifiers: *BOD mass balance, *Instream aeration, Recorded effluents, Unrecorded BOD loading, Background BOD loading.

Planning of water quality control must include a ystems analysis of the entire basin. This must include all sources of pollution, not just the recorded effluents. In New Jersey, study of pollution sources of three watersheds indicated large unrecorded BOD loadings. Accordingly, it may be more difficult than anticipated to meet water quality standards by treatment alone. To meet this situation a ystems analysis of the Passaic River has been conducted by the method of BOD mass balance analysis, and tests and studies have been made of instream aeration, using prototype equipment of two different types. Comparative estimates indicate hat an improvement to meet approved standards by waste treatment alone would be much more costly than would instream aerators. (Whipple-Rutgers)
W71-03226

ESTABLISHMENT AND OPERATION OF METROPOLITAN SEWERAGE COMMISSIONS.
For primary bibliographic entry see Field 06E.
W71-03262

BRUSH V LEHIGH VALLEY COAL CO (LIABILITY FOR COAL WASTE DEPOSITION).
For primary bibliographic entry see Field 06E.
W71-03266

THE MERCURY POLLUTION PROBLEM IN MICHIGAN AND THE LOWER GREAT LAKES AREA (A SUMMARY OF INFORMATION AND ACTION PROGRAMS),
Michigan Water Resources Commission, Lansing.
W. G. Turney.
May 1970. 12 p, 10 ref.

Descriptors: *Michigan, *Water pollution, *Pollution abatement, *Chemical wastes, Pollutants, Pollutant identification, Investigations, Water pollution sources, Governments, Water pollution effects, Water pollution control, Legal aspects, Lake Erie, Great Lakes, Ecology, Laboratories, Laboratory tests, Fish, Fishkill, Fish conservation, Metals.
Identifiers: *Mercury pollution.

The mercury pollution problem in the St. Clair River, Lake St. Clair, the Detroit River, and Lake Erie is surveyed. Data gathered by numerous agencies within various governments is compiled and there is a preliminary assessment of the problem. The report attempts to show how Michigan learned of the problem, what action has been taken, what action is planned, and what further needs to be done. An historical review of mercury contamination and investigative work in Japan, Sweden and Canada is presented. The clinical symptoms of mercury poisoning in man are enumerated and mercury uptake by fish discussed. The results of laboratory testing for mercury concentrations in fish by various governmental laboratories are revealed. The report discloses action programs by the Michigan Water Resources Commission relating to the control of mercury discharges. Action has been taken against Wyandotte Chemical Company, and General Electric Company, the mjaor Michigan mercury pollution sources. (Powell-Florida)
W71-03294

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

WATER INFLOW COMPUTATION OF THE PLANNED ANKARA CERKESHOYUK RESERVOIR,
Topraksu Central Research Inst., Ankara (Turkey).
For primary bibliographic entry see Field 04A.
W71-02804

AN ASSESSMENT OF OPTIMIZATION TECHNIQUES AS APPLIED TO WATER RESOURCE SYSTEMS,
Environmental Dynamics, Inc., Los Angeles, Calif.
John A. Dracup, Fereidoun Mobasheri, and Miguel A. Cardenas.
Available from NTIS as PB-196 361, $3.00 in paper copy, $0.95 in microfiche. Research Project Report, August 1970. 170 p, 4 fig, 331 ref, 3 append. OWRR Project X-103 (No 1996) (1).

Descriptors: Optimization, Optimum development plans, Planning, *Review, Bibliographies, *Systems analysis, Water resources development, *Model studies, *Hydraulic systems, *Water storage, *Water conveyance, *Groundwater, *Conjunctive use, *Water quality control, *Desalination.
Identifiers: Optimization techniques, Data management.

The research undertaken in the use of Optimization Techniques in the analysis of water resources systems is assessed. The most significant research in five important areas is covered; hydrologic systems; surface water storage and conveyance systems; groundwater and conjunctive groundwater systems; water quality control systems; and desalination systems. The areas of modeling and data management as they apply to water resources are discussed. The significant water resources problems to which researchers in systems analysis have addressed their efforts and the historic development of the use of system analysis techniques in each of these areas is presented. The value of this research and the extent to which current research efforts are solving the identified problems are presented. Current research and development needs and their priorities are delineated in each of the five areas.
W71-02878

ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
Warren Viessman, Jr.
Available from NTIS as PB-196 365, $3.00 in paper copy, $0.95 in microfiche. Publication No 3, Water Resources Research Institute, Univ. of Nebraska, Project Completion Report, June 1970. 10 p, 197 ref, 1 append. OWRR Project A-016-NEB (1).

Descriptors: *Mathematical models, *Water resources, *Planning, Cost, Computer programs, Economics, Technical feasibility, Nebraska, *Model studies, Water resources development.

This project was designed to explore the economics of instituting a serious modeling effort within a state water planning agency and to assess the technical limitations on the use of current models for solving planning-oriented problems. The state of Nebraska was used as a case study. The research effort concentrated on two aspects of the modeling approach to state water resources planning - namely the cost of developing and sustaining such programs and the effectiveness expected. Included were minimal professional requirements to conduct an adequate program at various levels such as: (a) use of existing models and computer programs; (b) refinement and improvement of existing models and computer programs to meet specific needs and (c) the development of new models and modeling techniques. This phase provided guidelines by which costs of state water resources planning resulting from a modeling approach can be assessed. The second phase reviewed the current efforts in mathematical modeling relative to their applicability to water resources planning problems. Has 197 references. (Kriss-Cornell)
W71-02879

MAXIMUM UTILIZATION OF SCARCE DATA IN HYDROLOGIC DESIGN,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 07C.
W71-02919

DETERMINATION OF PROBABILITY DISTRIBUTION OF MAXIMUM DISCHARGES ON THE BASINS OF ALL OBSERVED FLOODS,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 02E.
W71-02929

IMPROVED PRECISION OF FUTURE HIGH FLOODS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 02E.
W71-02930

COST-BENEFIT ANALYSIS FOR INLAND NAVIGATION IMPROVEMENTS,
Northwestern Univ., Chicago, Ill. Econometrics Center.
For primary bibliographic entry see Field 06B.
W71-02981

TIME SEQUENCING OF ELEMENT CONSTRUCTION IN A MULTI-RESERVOIR SYSTEM,
Water Resources Engineers, Inc., Springfield, Va.
G. K. Young, J. C. Moseley, and D. E. Evenson.
Water Resources Bulletin, Vol 6, No 4, p 528-541, July-August 1970. 32 p, 5 fig, 1 tab, 5 ref.

Descriptors: *Optimization, *Simulation analysis, *Computer programs, *Time series analysis, *Multi-purpose reservoirs, Economics, Constraints, Canals, Monte Carlo method.

The objective of this paper was to describe a computer-oriented procedure for aiding resource planners concerning construction staging decisions about reservoirs and canals. The scheme depended upon rapid computer solutions of a simulation which was constructed to represent the physical and economic response of the water system over time. The objective was to minimize the economic variable subject to the constraint that increasing demands over time were satisfied. The physical or engineering answers to the problem were the points in time at which the reservoirs and canals became functioning members of the overall system. Monte Carlo experiments upon multiple artificial reservoir inflow data were required to determine risks. The surface water transfer and storage system was described by a set of canals which join reservoir and demand points. The scheme considered an ultimate network geometry which was prespecified. There were two reservoir capacities at each site: zero or design capacity. Inflows and demands were also prespecified with the time interval for these variables as one month. The time frames for construction decisions on reservoirs and canals was one year. The decision variable set was comprised of reservoir and canal start times. The response evaluation required a computer simulation model which performed an economic feasibility study for each combination of decision variables. (Kriss-Cornell)
W71-03069

THE ESTUARINE VERSION OF THE COLHEAT DIGITAL SIMULATION MODEL,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
D. G. Daniels, J. C. Sonnichsen, and R. T. Jaske.
AEC Research and Development Rep, BNWL-1342, UC-70, Waste Disposal and Processing, June 1970. 40 p, 26 fig, 7 ref.

Descriptors: *Simulation analysis, *Digital computers, *Estuaries, Spatial distribution, Temporal dis-

tribution, Physical properties, River flow, Columbia River.

The COLHEAT simulation model, developed jointly on Division of Production and Division of Reactor Development and Technology funds for the Atomic Energy Commission, was modified to simulate spatial and temporal variations of temperature, chemical, and radionuclide concentration above the salt intrusion in coastal plain estuaries where the river flow is dominant. This report explained these modifications and described a case study on the Columbia River estuary. The major modifications of the existing COLHEAT model which were necessary to develop an estuarine version were performed on: (a) spatial variations in flow; (b) water transport and (c) partial mixing. The primary objective of the case study was to examine the interaction of tow plants along the lower Columbia River estuary. The steps included were river stage determination, river flow calculation, partial mixing and temperature simulation. (Kriss-Cornell)
W71-03070

RAINFALL DISTRIBUTIONS AND SIMULATION MODELS,
University of New England, Armidale (Australia).
For primary bibliographic entry see Field 02B.
W71-03071

SYMPOSIUM: COST BENEFIT ANALYSIS - SPATIAL AND TEMPORAL ALLOCATION OF IRRIGATION WATER: SOME POLICY MODELS AND EXAMPLES,
University of New England, Armidale (Australia); and Guelph Univ. (Ontario).
For primary bibliographic entry see Field 03F.
W71-03072

MATHEMATICAL MODELING OF GULF COAST ESTUARIES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W71-03074

SPURIOUS CYCLES IN WATER RESOURCES SYSTEMS,
Kansas State Univ., Manhattan. Dept. of Economics.
Arlo W. Biere.
Water Resources Bulletin, Vol 6, No 6, p 885-892, November-December 1970. 8 p, 4 fig, 11 ref.

Descriptors: *Time series analysis, *Statistical models, *Streamflow forecasting, Statistics, Statistical methods, Stochastic processes, Water management (Applied), Reservoir design, Reservoir operation, Analytical techniques.
Identifiers: *Streamflow analysis.

Analytical procedures for deducing from annual streamflow data information required for water resources systems planning are reviewed. The procedures rely on two techniques to determine the extent that cycles exist in annual time series data. The first is to observe how the time series behaves around the mean annual flow. If it tends not to move across the mean frequently, it is concluded that a cyclical nature exists. The second technique is to observe the time path of accumulated departures from the mean annual flow. The validity of both techniques is questioned, the first because it uses mean flow as 'normal' or the flow that the time series should fluctuate around, and the second because the accumulated departure from the mean time series will be autocorrelated even when the individual annual or seasonal flow observations are uncorrelated. Alternative analytical techniques, which find no cycles, are suggested. (Knapp-USGS)
W71-03124

A SYSTEMS STUDY OF STORM RUNOFF PROBLEMS IN A NEW TOWN,
Hittman Associates, Columbia, Md. Environmental Sciences and Engineering Dept.
Charles W. Mallory, and John J. Boland.
Water Resources Bulletin, Vol 6, No 6, p 980-989, November-December 1970. 10 p, 4 tab, 7 ref. EPA-WQO Grant 15030FM, Contract 14-12-20.

Descriptors: *Storm runoff, *Urbanization, *Systems analysis, *Simulation analysis, Mathematical models, Computer models, Maryland, Water pollution control, Water supply, Optimization, Computer programs, Water reuse, Sediment control.
Identifiers: *Columbia (Md), *Urban hydrology.

A system study was conducted on the use of a large number of small reservoirs dispersed throughout an urban community as a means of storm water pollution control. The study was based on an area within the 'new city' of Columbia, Maryland. Water collected and stored in the reservoirs is treated for release or use in meeting subpotable and potable water demands in the community. Design and performance criteria were developed for such a system. A simulation model and a computerized evaluation technique were used to select the optimal locations and system configurations. The results of this study indicated that such a system would be less expensive than a conventional engineering approach to storm water pollution control. Further, the benefits derived from use of the storm water as a water supply can offset a portion of the cost of pollution control. Several secondary benefits also result from this concept including erosion and sediment control, storm flow dampening, and recreational facilities. A program is now underway to demonstrate this concept in Columbia, Maryland. (Knapp-USGS)
W71-03125

ECONOMICS OF CANNERY WASTE TREATMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.
For primary bibliographic entry see Field 05D.
W71-03219

OPTIMAL POLICY FOR RESERVOIR OPERATION,
California Univ., Los Angeles. School of Engineering and Applied Science.
Ricardo C. Harboe, Fereidoun Mobasheri, and William W. Yeh.
Journal of the Hydraulics Division, Proceedings, American Society of Civil Engineers, Vol 96, No HY-11, p 2297-2308, November 1970. 3 fig, 4 tab.
OWRR Project No B-061-CAL.

Descriptors: *Reservoir operation, *Dynamic programming, *Multiple-purpose reservoirs, *Decision making, *Water policy, *Water quality control, Water control, Economics, Reservoir design, Reservoirs, Optimum development plans, Long-term planning, Multiple-purpose projects, River basin development, Water resources development, Optimization, Control, Planning, Administration, Evaluation, Management.
Identifiers: *Folsom Reservoir, California.

A modified dynamic programming model based on an alternative objective function useful in determining optimum long range operating policy for a single multi-purpose reservoir is presented. Reservoir uses which are included in the program are: water supply, peak and dump energy supply, and flood and water quality control downstream from the dam. The physical objective is the determination of optimum monthly releases, and monthly storage contents of the reservoir. The economic objective is the maximization of annual equivalent revenue from the operation. In order to keep computer time to a minimum, the dimensionality of the problem was decreased by reducing certain variables to parameters. In this way the dynamic programming was reduced to finding optimum monthly water releases from the reservoir so tha revenue from power production is maximized. The program was demonstrated on the Folsom Reservoir on the American River in Northern California. Historical stream flow data were used, but it was concluded that other types of data could be applied equally well. The program can be easily expanded to include other reservoir uses through the use of additional parameters. It is suggested that the program could be used as a subroutine in a design problem by converting parameters such as power plant and reservoir capacity to decision variables. (Hewett-Rutgers)
W71-03220

6B. Evaluation Process

MERCER COUNTY, NEW JERSEY, COMPREHENSIVE PLAN: ANALYSIS OF WATER SUPPLY AND SEWERAGE FACILITIES OF MERCER COUNTY.
Mercer County Planning Board, Trenton, N.J.
For primary bibliographic entry see Field 05D.
W71-02834

EXPORT OF MISSISSIPPI RIVER WATER TO TEXAS AND NEW MEXICO,
Bureau of Reclamation, Austin, Tex.
H. P. Burleigh.
Journal of the American Water Works Association, Vol 62, No 6, p 367-375, June 1970. 9 p.

Descriptors: Planning, *Project planning, Project benefits, *Surplus water, Project feasibility, *Water resources development, Legal aspects, New Mexico, Inter-agency cooperation, Water transfer, Texas, Louisiana, Groundwater recharge, Mississippi River, Investigations, Irrigation water, Water management (Applied), Public benefits.
Identifiers: *Interbasin water transfer, Mississippi River Commission, Water-use study.

The possibility of exporting surplus water from the Lower Mississippi River to Texas and New Mexico is increasing with the decrease in groundwater resources available to these states. Four viewpoints examining this possibility are: (1) Federal studies, (2) the Mississippi River Commission studies, (3) the State of Louisiana Department of Public Works studies, and (4) the State of Texas Water Development Board studies. No water project in history remotely approaches the size of the import project needed to maintain the economy of the Texas-New Mexico area. The project cannot be planned and developed solely as a water supply for western Texas and eastern New Mexico. There is no assurance that a single drop of Mississippi River water will ever be available for export. Such assurance would require the concurrence and support of the states that depend on the Lower Mississippi River system to sustain major sections of their economies. To obtain the cooperation of those states, the project is being conceived as a truly interregional undertaking that will provide benefits from one end to the other and not solely in western Texas and eastern New Mexico. (USBR)
W71-02852

CLIMATES OF WEST PAKISTAN ACCORDING TO THORNTHWAITE'S SYSTEM OF CLASSIFICATION OF CLIMATES,
For primary bibliographic entry see Field 02A.
W71-02869

THE IMPACT OF DIFFERENT LEVELS OF WATER DEVELOPMENT ON TEXAS AGRICULTURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 03F.
W71-02876

ATER RESOURCES AND REGIONAL LAND-E PLAN,
rza Engineering Co., Chicago, Ill., Water sources Planning Div.
nes C. Ringenoldus.
CE Proceedings, Journal of the Sanitary En-eering Division, Vol 96, No SA 6, Paper 7735, p 11-1320, December 1970. 10 p, 3 ref.

scriptors: *Water resources development, and use, *Planning, Urbanization, Sanitary en-eering, Water pollution, Natural resources, ter pollution control.
ntifiers: *Regional planning, Economic analysis.

ter resources development and management ns for urbanizing areas must be prepared within framework of a regional land-use plan if the ter resource is to be preserved, protected, and ized efficiently. Land and water resource nning should be concurrent and interacting so t land use does not exceed the capability of the ter resource base and so development of water ources can best serve the urban community. ter resources plans for urban areas should in-de consideration of all purposes and retain max-im flexibility for future decisions. A recom-nded planning procedure includes the following ps: study design, establishment of objectives nciples and standards, inventory, analysis and ecast, formulation of alternative plans, plan test l evaluation, and plan selection. The selection of plan to be adopted is the prerogative of the blic, and the planner is responsible for formulat-viable alternatives from which selection can be de. (Woodard-USGS)
71-02903

ATER RESOURCES DEVELOPMENT IN ST PAKISTAN,
st Pakistan Water and Power Development thority, Dacca.
r primary bibliographic entry see Field 04A.
71-02915

OUNTRY REPORT FOR PAKISTAN,
igation, Drainage and Flood Control Research uncil, Rawalpindi (Pakistan).
Anis Ahmed.
Proceedings of Central Treay Organization minar on Evaluation of Water Resources With arce Data, March 4-8, 1969, Tehran, Iran, p 57-, January 1970. 17 p, 2 fig, 5 tab.

scriptors: *Water resources development, oreign projects, *Programs, Hydrologic data, ging stations, Precipitation (Atmospheric), aporation, Temperature, Solar radiation, Hu-dity, Atmospheric pressure, Wind velocity, Sedi-nts, Decision making.
ntifiers: *Pakistan, Scarce data.

ographic and hydrologic conditions for East and est Pakistan are described and summaries of the drological stations, instrumentation, quality of e data, and hydrological forecasting from scarce ta are given. Separated by 1,000 mi of Indian ter-ory, the two parts of Pakistan differ very much in mate, language, topography, and water sources. The plains, plateaus, and mountains rough which the Indus River and its 5 major butaries flow in West Pakistan contrast with the uvial plain of the Ganges, Brahmaputra and the eghna which combined form the largest delta in e world on which East Pakistan is situated. The st arid and desert region of the West contrasts th the humid and hot climate with heavy rains in st Pakistan. The Indus Basin is faced with oblems of waterlogging, salinity, and alkalinity, gradation of river bed, and periodic floods. East kistan is plagued by recurring floods, droughts, d cyclones for which systematic hydrological sur-ys are needed for basin planning and manage-ent operations. Different agencies are making ob-rvations, mostly for precipitation and tempera-re data, but a few gaging and discharge measur-g stations are operated at important places. The Directorate of Hydrology maintains 228 stations for recording rainfall, evaporation, temperature; 123 of which are for stream gage and discharge sites. (Lang-USGS)
W71-02916

COUNTRY REPORT FOR UNITED KINGDOM,
Water Resources Board, Reading (England).
N. A. F. Rowntree.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 75-86, January 1970. 12 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Water resources, *Programs, *Planning, Rainfall, Runoff, Evaporation, Surface water, Groundwater, Telemetry, Reservoir storage, Hydrographs, Watershed management, Hydrologic data.
Identifiers: *United Kingdom, Scarce data.

The majority of water conservation schemes in the United Kingdom have until the present time been designed on the basis of scarce data. In 1963, a Water Resources Board was set up to guide water resources planning and development at national level for England and Wales and operation through River Authorities organized on a natural catchment area basis. Each river authority is responsible for hydrometric development within the area. In this paper the principal ways in which hydrometric data are regarded as scarce were considered and the ways in which the scarcity can be overcome and made good for water resource assessment are outlined. Data may be scarce for a particular variable. For example, rainfall may have been measured, but not runoff or evaporation; data periods are too short or not sufficiently representative or not accurate enough for the needs. Automatic recording instrumentation is being accomplished through the new scheme of the Water Resources Board. A third of the 1,500 new rain gages will record on magnetic tape the measured rainfall and time intervals. Punched tape digital recorders for water level are being installed as standard at most stream-gaging sites and on groundwater observation wells. (Woodard-USGS)
W71-02917

COST-BENEFIT ANALYSIS FOR INLAND NAVIGATION IMPROVEMENTS,
Northwestern Univ., Chicago, Ill. Econometrics Center.
Leon N. Moses, Lester B. Lave, James P. Stucker, William B. Allen, and Michael V. Beuthe.
Institute for Water Resources, Report 70-4, October 1970, Vol I, 63 p; Vol II, 773 p; Vol III, 474 p. Dept of the Army, Corps of Eng. DA-49-129-CIVENG-65-23.

Descriptors: *Cost-benefit analysis, *Cost analysis, *Benefits, Costs, Project planning, Cost allocation, *Multiple-purpose projects, *Navigation, Planning, Water resources development, *Water policy, *Transportation, *Inland waterways, Highways, Railroads, *Water supply, *Water demand, Water costs, Water requirements, Supply, Demand.
Identifiers: Transportation alternative, Transportation demand, Modal split, Discriminant analysis, Regression analysis, Transportation benefits, National income benefits, Process cost functions, Line haul cost functions, Joint costs, Production function of transportation modes, Engineering cost functions, Statistical cost functions, Intermodal competition, Private costs, Public costs, Externalities, Regulatory behavior.

This report contains (1) summary report, (2) demand and cost analysis, and (3) regulatory policy and intermode competition. Past discussions of the alternative ways of measuring the benefits of navigation improvements have centered around three techniques. Two of these techniques are based on rate comparisons: The method legislated by Congress as part of the bill creating a Department of Transportation uses projected rates for water transportation and existing rates for its competitors; the projected rate method uses expected rates for water transportation and its competitors. Both techniques are incorrect in the sense that they measure transfers of income from some groups to other groups rather than economic benefits. The third method focuses on the long run cost functions of the modes. It defines the benefit of a navigation improvement as the reduction in the total (present) value of resources, whether provided by government or private firms, that society can withdraw from transportation while still satisfying transportation demands. If all commodities have transportation demand functions that are perfectly inelastic, the method is essentially correct but somewhat incomplete. It ignores certain costs, such as the cost of time, that are inherent in transportation but are not part of carriers' cost functions. The cost method should be modified and these indirect costs taken into account. Failure to do so biases the measurement of benefits in favor of water transportation, because this mode tends to have an advantage in carrier costs but a disadvantage in other costs. The pure cost approach, which ignores indirect costs, can lead to the construction of uneconomic projects. Transportation demand functions appear to be highly, but not perfectly inelastic. Navigation improvements that reduce costs of transportation will, therefore, cause the tonnage shipped to increase somewhat. The assumption that total tonnage is fixed at any given point of time does not rule out the possibility of considering trend increases. It does tend, however, to understate the benefits of improvements. The advantages of the assumption are that it greatly reduces the complexity of project evaluation or its vagaries.
W71-02981

A CRITIQUE OF FEDERAL WATER RESOURCES POLICIES: HYDROELECTRIC POWER VERSUS WILDERNESS WATERWAY ON THE UPPER MISSOURI RIVER,
Cornell Univ., Ithaca, N.Y.
Carlos David Stern.
PhD Thesis, Cornell University, 2 vols, February 1971. 735 p, 64 tab, 30 fig. OWRR Project A-024-NY (1).

Descriptors: *Water policy, *Water resources development, Legislation, Governments, *Hydroelectric power, *Costs, Hydroelectric plants, Hydroelectric project licensing, Electric power, Recreation, Flood control, Cost-benefit analysis, *Cost allocation, *Missouri River, Cost analysis, *Federal project policy.

The purpose was to evaluate a particular Federal report in terms of its usefulness to decision-makers and to the public. Since the Joint Report for Development of the Reach of the Missouri River Between Fort Peck and Fort Benton was intended to serve as a reliable guide to Congress in reaching a decision concerning the fate of the last natural reach of a major U.S. river, it was found to be particularly well suited to serve as a case study. This thesis is organized into two parts: Part I deals with the historical and political background: a discussion of the Missouri River Basin development since 1944, a presentation of the setting against which the benefits of the proposed projects are tested in Part II, and a look at what actions followed the release of the Joint Report after 1963 and up to the present. While Part I deals primarily with the social and political context, Part II is a critique of the benefits and the costs of the various projects in the Joint Report. The discussion of benefits focuses on: electric power, replacement flood control and recreation. The discussion of costs includes an evaluation of some components of the original cost estimates and a discussion of omissions from the Joint Report. There is throughout Part II an ongoing attempt to relate benefits to costs on the basis of the revised data, in order to demonstrate the sensitivity of the outcome to shifts in some key factors such as hydroelectric plant factor, discount rate, and stream flow.
W71-03016

SYSTEM ECONOMIC RESPONSE TO WATER QUANTITY AND QUALITY - FUNDAMENTAL CONSIDERATIONS,
Utah Water Research Lab., Logan.
D. W. Hendricks, N. P. Dixon, and R. S. Whaley.
Water Resources Bulletin, Vol 6, No 4, p 682-694, July-Aug 1970. 13 p, 8 fig, 1 tab, 4 ref.

Descriptors: *Systems analysis, *Water quality, *Water supply, *Optimization, *Economics, Water allocation (Policy), Utah.
Identifiers: Total net benefits, Algorithm, Little Bear River.

A systems analysis approach for assessing the economic effect of both the quantity and quality of water was outlined. The allocative problem was considered as a joint production model. The first phase was to allocate between extensive and intensive factors of production within a water use and then, using the optimum mix of these two categories of variables for each use (called 'the intensive effect') to allocate water quantity and quality between the various uses (called 'the extensive effect'). The results of various alternative policy decisions were then assessed in terms of economic criteria. The relationship between water quantity, water quality and system economic response to permutations of these variables on any given water use, and the allocation of water among competing uses was outlined by means of a conceptual model. The whole system was evaluated for its different permutations in water use by Total Net Benefits (TNB). The Little Bear River system in the south of Cache Valley in Northern Utah was the subject of a river basin quality-quantity modeling project used as a case study. It illustrated application of the general algorithm for net benefits. The analytical approach for assessing net benefits for various mixes of land (or miles of trout system) and applied water for irrigation of barley and trout production respectively was shown. (Kriss-Cornell)
W71-03067

SYMPOSIUM: COST BENEFIT ANALYSIS - SPATIAL AND TEMPORAL ALLOCATION OF IRRIGATION WATER: SOME POLICY MODELS AND EXAMPLES,
University of New England, Armidale (Australia); and Guelph Univ. (Ontario).
For primary bibliographic entry see Field 03F.
W71-03072

ANALYSIS OF TOURISM AND RECREATION POTENTIAL OF MERAMEC PARK RESERVOIR REGION IN MISSOURI.
Economic Research Associates, Los Angeles, Calif.

Available from NTIS as PB-189 053, $3.00 in paper copy, $0.95 in microfiche. March 1969. 280 p.

Descriptors: Missouri.
Identifiers: *Recreation, Feasibility studies, Economics, Commerce, Tables, Costs, *State parks, *Meramec Park Reservoir.

The objective of the study was to identify feasible travel and recreation attractions for development on those publicly owned lands which are expected to be located around the reservoir. Specifically, it included: (1) Completion of a comprehensive and detailed inventory and analysis of travel and recreation activity in the state, and more specifically in the Meramec Park Reservoir area; (2) Consumer market research to determine the recreation needs of residents of the area as well as travelers who currently visit the Meramec Park Reservoir region or can be expected to visit there in the future; and (3) Identification of recreation and visitor attractions which have potential for possible development in the designated area.
W71-03077

REGIONAL AND LOCAL LAND USE PLANNING VOLUME IV.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 413, $3.00 in paper copy, $0.95 in microfiche. Study Report No. 10, February 1970. 164 p.
Identifiers: *Management planning, Natural resources, *Economics, *Law, Maps, Employment, Climatology, Terrain, Soils, Minerals, Water supplies, Site selection, Tables, Land use planning, Regional planning and development, *Public land.

Economic profiles; (Region I Los Angeles Las Vegas, Region II. Pacific Northwest Region III. Upper Rocky Mountains, Region IV, Blue Ridge - Shenandoah); Comprehensive general plan outline comparison table. (See also W71-03078)
W71-03079

A METHODOLOGY FOR EVALUATION OF THE ECONOMIC DEVELOPMENT OF THE ADMINISTRATION'S PUBLIC WORKS PROGRAMS.
EBS Management Consultants, Inc., Washington, D.C.

Available from NTIS as PB-189 676, $3.00 in paper copy, $0.95 in microfiche. May 1969. 117p.
Identifiers: *Economics, *Urban planning, *Federal budgets, Effectiveness, Reviews, Commerce, Employment, Water supplies, Sanitary engineering, Roads, Hospitals, Education, Recreation, Seacost Organizations, Questionnaires, Low Income families, Economic development, Industrial parks, Ports, Evaluation, Public works programs.

The report presents the results of preliminary studies conducted for the Economic Development Administration (EDA) to prepare a methodology for the evaluation of public facility projects. The EDA public works program has provided financial assistance since early 1966 for the construction of various types of public facilities for the purpose of assisting certain designated areas in improving the opportunities for the successful establishment or expansion of industrial or commercial plants or facilities; in otherwise helping to create long-term employment opportunities; or in providing benefits for those who have been unemployed for a long time or who come from low income families.
W71-03086

CENTRAL OREGON COAST, VOLUME I. PHYSICAL CONDITIONS AND PRESENT DEVELOPMENT.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 731, $3.00 in paper copy, $0.95 in microfiche. 1969. 46 p.
Identifiers: Management planning, *Oregon Terrain, Soils, Climatology, Drainage, Tides, Hydrology, Seacoast, Law, Urban areas, *Central Coast Region, Oregon, *Regional planning and development, Land use, Land titles, Watersheds, Subdivision regulations.

Location, Topography, Geology and soils: Climate: Watersheds and drainage; Land ownership; Land use: Regulatory codes and ordinances; and Implications for further development. (See also W71-03200 thru W71-03207)
W71-03199

CENTRAL OREGON COAST. VOLUME II. ECONOMIC PATTERNS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 732, $3.00 in paper copy, $0.95 in microfiche. 1969. 58 p.
Identifiers: *Management planning, *Oregon, *Economics, Management planning, Seacoast, Forestry, Agriculture, Recreation, Mining engineering, Fishes, Harbors, Commerce, Natural resources, Scientific research, Employment, Wages, Industries, *Central Coast Region (Oregon), *Regional planning and development, Land titles, Fisheries.

General economic forces: Natural resource economy; Jobs and development: Employment potentials. (See also W71-03199)
W71-03200

CENTRAL OREGON COAST, VOLUME III, FOREST PRODUCTS INDUSTRY.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 733, $3.00 in paper copy, $0.95 in microfiche. 1969. 49 p.
Identifiers: *Management planning, *Oregon, *Industries, Wood, Forestry, Trees, Economics, Employment, Predictions, Seacoast, *Central Coast Region (Oregon), *Lumbering, *Wood products industry, *Regional planning and development, Public land, Land titles.

Forest resources; Timber supply and log flows; Forest products establishments and employment; Employment forecasts for the wood products industry. (See also W71-03199)
W71-03201

CENTRAL OREGON COAST. VOLUME IV. AGRICULTURE.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 734, $3.00 in paper copy, $0.95 in microfiche. 1969. 51 p.
Identifiers: *Management planning, *Oregon, *Agriculture, Management planning, Production, Employment, Industries, Commerce, Periodic variations, Economics, Transportation, Animals, Rural areas, Advanced planning, *Central Coast Region (Oregon), *Regional planning and development, Agricultural products, Crop diversification, Land use, Marketing, Livestock.

This report outlines some of the factors contributing to the future development of agriculture in the area, presents a quantitative estimate of the land requirements involved, evaluates the impact of agriculture upon the present and future economy of the area, and finally makes some more or less specific suggestions relative to lands that should be reserved for various agricultural purposes. (See also W71-03199)
W71-03202

CENTRAL OREGON COAST, VOLUME V. COMMERCIAL FISHING AND FISH PROCESSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 735, $3.00 in paper copy, $0.95 in microfiche. 1969. 37 p.

Descriptors: *Management planning, *Oregon, *Industries, *Seafood, Economics, Commerce, Harbors, Processing, Fishes, Crustacea, Pelcypoda, Automation, Employment, Scientific research, Advanced planning, Seacoast.
Identifiers: *Central Coast Region (Oregon), *Commercial fishing, *Regional planning and development, Fish processing, Fisheries, Marine fishes, Food industry, Marketing, Salmon, Tunas, Market value.

The fisheries industry, as defined for purposes of this study, includes commercial fishing, commercial fish processing, and the wholesale and retail distribution of fish. It is the third most important industry in the four-county coastal strip area covered under the study; it is an 'export industry' of the area. Although an analysis of the demand and supply factors affecting the fisheries industry na-

ionally and regionally can be related to the four-ounty coastal area covered under this study only n a very general way, it serves as a useful ramework within which to undertake this study. The fisheries industry as it functions within the tudy area is not an economic microcosm of the in-lustry nationally; however, characteristics of the roduction and marketing problems of the industry re similar on the local, regional, and national cale. As is shown later on, the economic impact of isheries in the study area generally reflects those haracteristics which mark the industry on the arger scale. (See also W71-03199)
W71-03203

CENTRAL OREGON COAST. VOLUME VI. RECREATION TOURISM.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 736, $3.00 in paper copy, $0.95 in microfiche. 1969. 79 p.

Descriptors: *Recreation demand, *Recreation facilities, Social needs, Land use, Water utilization, *Tourism, Camping, Boating, Parks.
Identifiers: Oregon coasts.

Criteria for development; Use and demand; Existing facilities and potentials and development; Responsibilities for recreation. (See also W71-03199)
W71-03204

CENTRAL OREGON COAST. VOLUME VII. POPULATION AND HOUSING.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 737, $3.00 in paper copy, $0.95 in microfiche. 1969. 29 p.

Descriptors: *Management planning, *Oregon, *Population, Growth, *Housing, Abundance, Predictions, Advanced planning, Seacoast, Recreation, Sociology, Economics, Employment.
Identifiers: *Central Coast Region (Oregon), *Regional planning and development, Demography, Socioeconomic status, Vacation homes.

Contents: Population trends 1950-1967; Population characteristics; Population forecasts; Housing trends and distribution; Forecast of 1985 housing needs; Implications for future development. (See also W71-03199)
W71-03205

CENTRAL OREGON COAST. VOLUME VIII. TRANSPORTATION AND UTILITIES.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 738, $3.00 in paper copy, $0.95 in microfiche. 1969. 52 p.
Identifiers: *Management planning, *Oregon, *Transportation, Management planning, Shipping (Marine), Railroads, Air transportation, Cargo, Cargo vehicles, Harbors, Terminal flight facilities, Traffic, Roads, Water supplies, Sanitary engineering, Electric power production, Fuels, Advanced planning, *Central Coast Region (Oregon), *Public utilities, *Regional planning and development, Sanitary sewers, Natural gas, Land use.

Ports and shipping; Highway transportation; Rail transportation; Air traffic system; Utilities. (See also W71-03199)
W71-03206

CENTRAL OREGON COAST. VOLUME IX: DEVELOPMENT PROBLEMS AND POTENTIALS.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.

Available from NTIS as PB-188 739, $3.00 in paper copy, $0.95 in microfiche. 1969. 17 p.

Descriptors: *Management planning, *Oregon, Problem solving, Advanced planning, Growth, Substitutes, Sociology, Economics, Natural resources, Recreation, Housing, Harbors, Shipping (Marine), Scientific research, Seacoast, Education, Organizations.
Identifiers: *Central Coast Region (Oregon), *Regional planning and development, Recommendations.

The first eight reports of this study (PB-188 731 through PB-188 738) of the central coast area each deal with some specific subject that is of particular importance to planning for the future development of the region. These reports indicate that the central coast of Oregon is richly endowed with many resources, and that the development of these resources is of importance to the region, the state, and the country. It is also apparent that there are some inherent developmental conflicts and problems that should be considered when planning decisions for the area are made. The purpose of this report is to summarize certain findings contained in the eight subject matter reports which indicate the probable characteristics of growth and change in the study area during the next twenty years. In addition, some implications of alternate specific development policies are noted in terms of their impact on all aspects of growth. (See also W71-03199)
W71-03207

A SOCIO-ECONOMIC STUDY OF NARRAGANSETT BAY, RHODE ISLAND,
Rhode Island Univ., Kingston. Dept. of Food and Resource Economics.
Niels Rorholm, Harlan C. Lampe, and Joseph F. Farrell.
Report (undated). 206 p, 11 fig, 41 tab, 10 charts, 123 ref. FWPCA Contract No 14-12-93.

Descriptors: *Estuaries, *Water resources, Estuarine environment, Economics, Rhode Island, Evaluation, Natural resources, Planning, Regional analysis, Bays, Benefits, Long-term planning, Social impact, Economic impact, Estuarine fisheries, Recreation demand, Recreation, Transportation, Waste disposal, Water resources development, Fisheries, Resources, New England, Multiple purpose.
Identifiers: Narragansett Bay, Marine industry.

Narragansett Bay may be viewed as a natural resource which in combination with labor, capital, and management produces multiple products and services. Products of the Bay which are discussed include commercial fisheries, defense establishments, recreation, bay transportation, marine oriented industry and commerce, research and education, waste disposal, and quality of the environment. Many of these uses compete with one another, others are complimentary, some are complimentary or competitive depending on the degree of use of each. An estuary is a complex of interacting systems and in turn is a part of a larger amalgam of systems relating to human activity. A clear picture of an estuary as a resource can result only from careful study of interacting physical, biological, technical, social and economic factors. It is important that these factors be considered together as much as is possible, and that studies of any one category be oriented such that they relate to and are translatable to the whole. In this way, some insight into the potential of the estuary may be gained, and some foundation laid for rational decision making and management. The integration of the various individual studies of specific areas requires the acknowledgment of and adherence to planning objectives. These objectives cannot be understood without extensive research. (Hewett-Rutgers)
W71-03217

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969: INTERIM REPORT NO 1.
National Water Commission, Arlington, Va.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.40. December 31, 1969. 73 p, 7 append.

Descriptors: *Water resources, *Water resources development, *Federal government, *Non-structural alternatives, Research and development, Water policy, Water conservation, Administration, Inter-basin transfers, Institutions, Multiple-purpose projects, Cities, Water law, Planning, Project purposes, Legal aspects, Social aspects, Water management (Applied), Water requirements, Water supply, Water utilization.
Identifiers: *Study commissions.

The National Water Commission's annual report for 1969 is a brief summary of the Commission's activities during its first year of existence. The first part of the report deals with the Commission's efforts to determine, with respect to the commission's goals, the reactions, requirements, and reasoning of water resources officials and other leaders in various regions of the United States. The report covers what the Commission learned regarding goals, objectives, priorities, planning, government institutions, water laws, inter-basin transfers, metropolitan areas, and other problems. The second portion of the report deals with information obtained from expert consultants and federal officials in the field of water resources. New trends and possibilities are reviewed. Part three of the report deals with the evaluation and weighing of what had been heard from the various regions and from water resources experts and, based on this information, the formulation of the Commission's study program. The fourth portion of the report describes Commission organization. The appendices contain a report by the Commission's Panel on Ecology and the Environment, dealing with some ecological principles and interactions between uses and the environment. (Powell-Florida)
W71-03295

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 06A.
W71-02879

HOW TO SELECT AND USE DRILL BITS PROFITABLY,
Delta Drilling Co., Tyler, Tex.
For primary bibliographic entry see Field 08C.
W71-02985

HOW TO CUT COSTS IN EXPLORATION DRILLING,
Miller and York Drilling Inc., Bakersfield, Calif.
C. F. Green.
World Oil, Vol 161, No 1, p 103-105, July 1965.

Descriptors: *Drilling, Exploration, *Contracts, Bids.
Identifiers: *Drilling economics, Drilling costs.

Working knowledge of drilling contracts can help geologists and other exploration personnel to assist in reducing cost of exploratory holes; excessive requests for unnecessary special equipment and drilling contracts with severe deviation limitations are two areas of potential savings. The geologist can assist operational management in selecting and specifying terms of drilling contracts by predicting

drillability of various formations, especially in areas where penetration rates are difficult to predict. The engineer should also be familiar with the different types of drilling contracts in order to plan drilling programs properly. (Campbell-NWWA)
W71-02995

FINANCING WATER SUPPLY AND SEWERAGE PROJECTS IN DEVELOPING COUNTRIES,
International Bank for Reconstruction and Development, Washington, D.C.
Juergen Krombach.
Columbia University Seminar on Pollution and Water Resources, Columbia University, New York, N.Y., September 1970. 26 p, 5 tab.

Descriptors: *Financing, *Loans, *Economics, *Capital, *Water Resources development, Water Supply, Waste water treatment, Public utilities, Project planning, Planning, Evaluation, Economic feasibility, Financial feasibility, Investment, Institutions.
Identifiers: *International Bank for Reconstruction and Development, *World Bank Group, Foreign aid, Bilateral aid, Multilateral aid, Under developed nations.

The objective of the paper is to explain the World Bank's criteria in selecting and appraising water supply, sewerage and other environmental sanitation projects. Bilateral and multilateral aid are discussed. The relative portions donated by various countries, both bilaterally and through multilateral agencies are presented, as well as the relative disbursement to various regions of the world. The various agencies of the World Bank Group are enumerated along with their origins, their functions, the nature of their loans and the sources of their funds. The general criteria for project appraisal by the World Bank Group are presented and discussed with respect to their suitability in relation to the general conditions of under-developed countries. Economic, technical, commercial, financial and institutional aspects of the World Bank's appraisals of various water supply and sewerage projects are presented. Details of policies and expectations of the World Bank are discussed with respect to their effect on the preparation of project plans. The administration of loans and the supervision of active construction projects by the World Bank are discussed. Future aims and interests of the World Bank in the field of water supply and sewerage are presented. (Hewett-Rutgers)
W71-03218

COST OF PROVIDING WATER FOR FIRE PROTECTION,
Jordan (Edward C.), Inc., Portland, Maine.
Donald R. Cote, and Alvin S. Goodman.
Journal American Water Works Association, Vol 62, No 7, p 407-411, July 1970. 2 fig, 3 tab.

Descriptors: *Water costs, *Separable cost allocation, *Cost allocation, Cost analysis, Cost sharing, Separable costs, Cost comparisons, Estimated costs, Costs, Utilities, Project planning, Planning, Rates.
Identifiers: *Fire protection, Rate making.

This study is based on the premise that each function of a water system should be paid for by charges based on the cost of providing the function, and therefore, water systems should be paid for by those who consume water and by those who are afforded fire protection. Three methods of allocating costs are: fire protection as an incremental cost; general service as an incremental cost; and the capacity-ratio method. Because the basic function of most water systems is to supply water for general consumption the first method has been selected as the most reasonable. A study of seven existing water systems was conducted to determine the incremental cost of fire protection. It was found that the incremental cost of fire protection decreases (on a percentage basis) with the increasing size of the system. The relationship between population and percent of total cost for fire protection was very strong. A definite relation between total water consumption and percent of total cost for fire protection also exists. Variables such as the area of the system, and the ratio of peak flows to maximum daily flows were found to be not as important. It is believed that the nature of the systems studied varied enough to make the results of this study applicable to other water systems as a guide line for determining the percent of total cost which may be attributed to fire protection. (Hewett-Rutgers)
W71-03221

A NEW FOCUS IN WATER SUPPLY ECONOMICS - URBAN WATER PRICING,
West Virginia Univ., Morgantown. Coll. of Commerce.
Patrick C. Mann.
Journal American Water Works Association, Vol 62, No 9, p 534-537, September 1970. 1 tab.

Descriptors: *Water rates, *Water costs, *Pricing, Use rates, Rates, Public utilities, Cost analysis, Marketing, Economics, Utilities.
Identifiers: *Rate structures, *Water rate analysis, Principal component analysis.

The rapid growth of urban areas and the increasing scarcity of water supplies have created a need for an economic analysis of urban water pricing. This paper discusses existing water rate structures, the methods by which they are determined, and problems which are encountered in their use. A statistical analysis of urban water prices is also presented. The technique of principal component analysis was used to analyze six measures of urban water price. These included the monthly metered rates for 500 cu ft, 1000 cu ft, 10,000 cu ft, 100,000 cu ft of water, the water revenue per million gallons produced, and the water revenue produced per million gallons sold. Principal component analysis is a statistical factor analysis which determines general patterns of association among variables on the basis of their intercorrelations. For the 113 water utilities examined by this method it was shown that the above six measures were 'relatively highly interrelated,' and were a general price index for these utilities. The results also indicated a strong association between the monthly metered rate for 100,000 cubic feet, and the water revenues per million gallons sold. A further investigation showed that the 25 utilities having the lowest water prices were located near large bodies of water, and the 25 utilities having the highest prices were privately owned. (Hewett-Rutgers)
W71-03222

6D. Water Demand

EXPORT OF MISSISSIPPI RIVER WATER TO TEXAS AND NEW MEXICO,
Bureau of Reclamation, Austin, Tex.
For primary bibliographic entry see Field 06B.
W71-02852

ALFALFA FOR FORAGE PRODUCTION IN ARIZONA,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02G.
W71-02868

THE IMPACT OF DIFFERENT LEVELS OF WATER DEVELOPMENT ON TEXAS AGRICULTURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 03F.
W71-02876

FORECASTING WATER DEMANDS AND SYSTEMS CAPABILITIES,
Illinois State Water Survey, Urbana.
Wyndham J. Roberts, Sandor C. Csallany, and Neil G. Towery.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 6, Paper 7745, p 1349-1360, December 1970. 12 p, 5 fig, 3 tab, 10 ref.

Descriptors: *Water demand, *Forecasting, *Water resources development, *Evaluation, *Illinois, Community development, Water supply, Planning, Hydrology, Reservoirs, Rivers, Groundwater, Wells, Sanitary engineering, Data collections.
Identifiers: Inventories, Operations research.

One feature of the 1968 Illinois Water Plan was concerned with the condition and future capability of water systems in 1200 incorporated communities. It was necessary to determine the condition of each water facility, such as its present pumpage, the filter plant capacity, and the water source capacity. Projections of water demands on each system to the year 1980, and a county basis to 2020, were made by using population estimates. By developing a gallons per capita per day relationship from present pumpage and present population data, corresponding 1980 values could be computed by using the appropriate projected population data. The technique for presenting these data is shown in both graphical and formula form. In addition, tables and graphs are included to show various paramater relationships and how the large amount of data were assembled in order to display projections individually, by counties, and by river basins. This water resource planning approach has a potential for wide use beyond the area for which it was developed. (Woodard-USGS)
W71-02905

ARIZONA AGRICULTURE 1969.
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W71-02967

THE DEMAND FOR WATER BASED RECREATION IN SOUTHWEST PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
Gerald Latortue.
Available from NTIS as PB-196 475, $3.00 in paper copy, $0.95 in microfiche. Water Resource Research Institute Publication, November 1970. 48 p, 2 append. OWRR Project A-015-PR (1).

Descriptors: *Water recreation, *Water demand, Industrial production, Ecology, Environmental effects, Feasibility study, Puento River, Attitudes, Social aspects, Recreation, Recreation facilities.
Identifiers: *Opinion research, Economic growth.

This study conducts a survey of existing water-based recreational areas and facilities in Southwest Puerto Rico to determine whether the water resource facilities are being fully utilized. Two series of personal interviews were conducted to determine the opinions of a sample of the users of these water-based recreational facilities. The results indicate that weekend holiday attendance at beaches is higher; people at water-based recreation facilities prefer swimming to sailing and surfing; the majority of visitors go to beaches year round. The author concludes that he demand for water-based recreational facilities in Southwest Puerto Rico is extremely low with a few exceptions. If the Puerto Rican Government succeeds in the industrial development of the Southwest region, the demand will increase considerably. In that case, the government should improve beach facilities, build better access roads and publicize the location of the more remote water recreation areas. However, government programs in these areas should also try to consider the ecology of the area and the potential environmental damage from wide scale industrial development. (Siegenthaler-Rutgers)
W71-03008

CITY OF PHILADELPHIA V PHILADELPHIA SUBURBAN WATER CO (COMPETING USES OF LIMITED RESOURCES).
For primary bibliographic entry see Field 06E.
W71-03233

6E. Water Law and Institutions

THE IMPACT OF FEDERAL WATER LEGISLATION AT THE STATE AND LOCAL LEVEL,
Central Washington State Coll., Ellensburg. Dept. of Geography.
Kenneth A. Hammond, Daniel P. Beard, and Keith V. Muckleston.
Available from NTIS as PB-196 309, $6.00 in paper copy, $0.95 in microfiche. Completion Report, Washington Water Research Center, Washington State Univ, Pullman, October 1970. 258 p, 25 tab, 14 fig, 269 ref. OWRR Project B-019-WASH (5).

Descriptors: *Recreation, Grants, Administration, *Institutions, *Legislation, Recreation demand, Recreation facilities, Institutional constraints, Political aspects, Political constraints, Water Quality Act, Legal aspects.
Identifiers: *Administrative institutions, Policy development, Intergovernmental impact, Land and Water Conservation Fund Act, Federal Water Project Recreation Act.

The Land and Water Conservation Fund Act and the Water Quality Act of 1965 are landmarks in resource policy. Both have altered the magnitude and emphasis of Federal, State, and local efforts. They will not be adequate but are necessary and desirable responses to changing conditions and social priorities. Though not without merit, the Federal Water Project Recreation Act does not equal the others in importance. State and local governments need the impetus provided by Federal programs of assistance and guidance. States have made significant institutional and financial adjustments to favor programs with long-range benefits which otherwise would languish. However, once the program is safely underway the Federal level should make every effort to withdraw from direct and detailed program supervision. The states should treat local governments with similar consideration. Basic geographical and ecological information is not entering the decision-making process. The finite nature of the earth and the inadequacy of any solution which requires ever greater dedication of resources to any particular use must eventually be recognized. Recreation has now been elevated to the status of a human and social need. The provision of low density activities will become progressively more important and more difficult with expanding human populations and urban agglomerations.
W71-02826

MORROW STEAMSHIP CO V SUPERIOR WATER, LIGHT AND POWER CO (LIABILITY FOR ACCIDENT CAUSED BY CABLE BEING FLOATED ON SURFACE).

31 F2d 486-488 (WD Wis 1928).

Descriptors: *Wisconsin, *Propellers, *Accidents, *Ships, Hazards, Judicial decisions, Legal aspects, Remedies, Admiralty, Damages, Navigation, Navigable waters, Ships, Boats, Channels, Buoys, Floating, Floats, Jurdisdiction, Federal jurisdiction, Competing uses.
Identifiers: *Obstructions to navigation.

Libelant steamship owner filed a libel against respondent for damages suffered when respondent's cable became entangled in the steamship's propeller. The cable had been floated to the surface of a channel to make repairs. Respondent cross-libeled for damage caused to the cable. Libelant contended the admiralty court had no jurisdiction for the cross-libel since it involved an instrument of land commerce. The court held both parties were at fault. The steamship had noticed the barrels floating the cable and should have delayed until the cable was pulled from the channel. Respondent had had a tugboat by the floating cable, but discharged it despite the frequent use of the channel and left only three men in a rowboat to move the cable. The court held that it had jurisdiction to hear the cross-libel since the cable was afloat in navigable waters when the accident occurred. (Morris-Florida)
W71-02838

CITY OF LOS ANGELES V BORAX CONSOL LTD (DETERMINATION OF UPLAND-TIDELAND BOUNDARY).

74 F2d 901-907 (9th Cir 1935).

Descriptors: *California, *Islands, *Boundaries (Property), *Tidal waters, Boundary disputes, High water mark, Meanders, Land tenure, Real property, Patents, Surveys, Reservation doctrine, Legal aspects, Judicial decisions, Adjudication procedure, United States, Administrative agencies, Relative rights.

Plaintiff city brought action against defendant corporation to quiet title to a portion of the shore of an island. Plaintiff claimed title in the tidelands through a grant from the state while defendant claimed title in the island through a patent from the United States. The meander line of the island described in defendant's patent was below the mean high tide mark; defendant claimed title to the meander line, whereas plaintiff asserted title in the tidelands to the mean high tide mark. The court determined that the boundary line of the island was the seashore rather than the patent meander lines. Since title to the tidelands had vested in the state before the United States surveyed the island, and the surveyor had not attempted to determine the tideland-upland boundary, the court held the meander line was not plaintiff's boundary. The court observed that the true boundary was the mean high tide mark, the location of which was a question of fact for a jury. The trial court's judgment was reversed and the case was remanded for determination of the mark. (Hart-Florida)
W71-02839

RYAN V CHICAGO B AND Q RR (CONGRESSIONAL AUTHORIZATION OF DAM CONSTRUCTION).
59 F2d 137-145 (7th Cir 1932).

Descriptors: *United States, *Dam construction, *Dam design, *Condemnation, Legislation, Dams, Appropriation, Judicial decisions, Legal aspects, Flood control, Navigable rivers, Mississippi River, Federal government, Eminent domain, Water rights, Riparian rights, Riparian land, Water resources development.

Plaintiff railroad company owned and operated a railroad along the shore of a river. Congress authorized and appropriated funds for erection of a dam on the river. Defendants, government officers, sought to condemn plaintiff's property for a dam site. Plaintiff instituted an action to enjoin defendants from proceeding with condemnation proceedings and construction of the dam. Plaintiff contended that Congress had specified construction of a movable, navigable type of dam, and defendants were erecting a fixed, non-navigable dam which was unauthorized and would flood plaintiff's property. Defendant contended that Congress had approved the dam construction. Furthermore, defendants contended that the bill should have been dismissed since the United States had not consented to be sued. The court held that defendant was authorized to construct a fixed dam. The court further held that the suit to enjoin the government officers was not a suit against the United States so as to require consent. The court stated that where Congress authorized dam construction, the Secretary of War had wide discretion to determine specific and detailed plans. (Powell-Florida)
W71-02840

LITTLE FALLS FIBRE CO V HENRY FORD AND SON (LIABILITY FOR LOSS OF POWER HEAD UPSTREAM FROM DAM AND HYDROELECTRIC PLANT).
127 Misc 834, 217 NYS 534-542 (1926).

Descriptors: *New York, *Dams, *Head loss, *Natural flow doctrine, Backwater, Hydraulic machinery, Industries, Power head, Riparian rights, Riparian land, Riparian waters, Navigable rivers, United States, Permits, Legislation, Federal Power Act, Legal aspects, Water rights, Eminent domain, Reasonable use, Judicial decisions, Obstruction to flow, Streamflow, Hydroelectric plants, Tailrace, Tailwater, Relative rights.

Plaintiff manufacturers owned certain riparian lands, water rights and water power rights along a navigable river. Defendant manufacturer operated a hydroelectric plant at a federal dam downstream from plaintiffs' property. Plaintiffs sued to enjoin defendant from maintaining flashboards on the dam so as to reduce the available power head for plaintiffs' hydraulic machinery and to recover damages for loss of water power. Plaintiffs contended that their right to the natural flow of the river and their water power rights were property rights which could not be damaged without compensation. Defendant contended that it was acting on behalf of and under license from the United States, that it could not be held liable without the consent of Congress and that its actions were for the benefit of commerce and navigation. The court noted that defendant's license under the Federal Power Act expressly provided that the licensee was responsible for any property damage and that, even if the work benefitted navigation, it would be subject to the fifth amendment prohibition against taking private property for public use without just compensation. The court granted the injunction and referred the case for findings as to damages. (Liptak-Florida)
W71-02844

IN RE CERTAIN LANDS IN CITY OF NEW YORK (CITY'S OWNERSHIP OF BEDS).
127 Misc 710, 217 NYS 544-565 (S Ct 1926).

Descriptors: *New York, *Boundary disputes, *Ownership of beds, *Navigable waters, Streams, Rivers, High water mark, Low water mark, Eminent domain, Cities, Condemnation, Compensation, Public rights, Proprietary power, Channels, Boundaries (Property), Land tenure, Administrative agencies, Legislation, Legal aspects, Judicial decisions, Beds.

The City of New York sought, through eminent domain proceedings, to acquire title to lands on the shore of the Harlem River. Part of the land involved was the bed of a creek to which the City alleged it held title. Claimants also alleged title, relying on a chain of conveyances dating from Dutch colonial authorities. The chain of title included a conveyance of all interest the state of New York held in the creek bed. The City alleged that the state grant was void because at the time of the conveyance the state had no interest to convey; the state had already effectively conveyed the land to a town. The trial court found for claimants. The state is presumed to hold title to lands under water, and the burden of proving otherwise is on the party asserting such. However, the grants through which the City claimed indicated ownership by the town only to the high water mark. On the other hand, claimants' title was supported by the evidence. Claimants further contended that they had acquired title by adverse possession and estoppel. Because of the proprietary use of the land by the City, the court held that these doctrines would apply. The City was estopped to deny claimants' title to the lands. Finally, the City could not attack claimants' title on grounds that the state grant reserved public right of entry. (Duss-Florida)
W71-02856

HYDROLOGICAL AND RELATED DATA PROGRAMS IN THE UNITED STATES OF AMERICA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07A.
W71-02918

FIFTY ENVIRONMENTAL PROBLEMS OF TIMELY IMPORTANCE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 05B.
W71-02953

BOARD OF HUDSON RIVER REGULATING DIST V FONDA, J AND G RR (CONDEMNATION OF RIGHT-OF-WAY FOR CONSTRUCTION OF RESERVOIR).

127 Misc 866, 217 NYS 781-799 (S Ct 1926).

Descriptors: *New York, *Navigable rivers, *Reservoirs, *Flood control, Dams, Condemnation, Eminent domain, Public health, Railroads, Administrative agencies, Federal jurisdiction, State jurisdiction, Watershed management, Flow control, Right-of-way, Benefits, Water conservation, Damages, Plans, Hudson River, Navigable waters, Judicial decisions, Legal aspects.

Plaintiff river regulating district sought to condemn part of defendant railroad's right-of-way. Plaintiff was acting pursuant to state law which created regulating districts and empowered them to construct reservoirs to regulate the flow of streams when required by the public welfare. Defendant contended that the board had not complied with the prerequisites to condemnation, alleging that plaintiff needed the permission of the interstate Commerce Commission under a federal law which stated that navigable rivers could not be obstructed without Commission consent. Defendant also alleged that the property was not being taken for a public use. The court found for plaintiff. The river on which the dam and reservoir would be constructed was not a navigable river under federal law. As to the Hudson River, the proposed improvements would improve the navigable capacity of the river by controlling the flow during dry and flood conditions. As to the nature of the public use, it was not fatal to the project that private interests would also benefit. Controlling the flow of streams had sufficient benefits for public safety and health to constitute a public use. (Duss-Florida)
W71-02957

PEOPLE EX REL MEXICAN TELEGRAPH CO V NEW YORK STATE TAX COMM'N (STATE MAY TAX FEDERAL LICENSEE'S FRANCHISE).
219 App Div 401, 220 NYS 8-18 (1927).

Descriptors: *New York, *Taxes, *Federal jurisdiction, *State jurisdiction, Federal government, Navigable waters, Ownership of beds, State governments, Legal aspects, Political aspects, Remedies, Judicial decisions, Government finance, Profit, Public lands, Public benefit.

Relator telegraph company sought to review a special franchise tax assessed by defendant state tax commission. Relator contended that it held a federal license and was therefore exempt from state taxation of its franchise. Relator maintained that it had acquired a presidential permit to operate its cables over submerged lands within the three-mile limit off of the coast of New York. Defendant contended that the state, owner of the submerged lands within the three-mile limit, could tax the franchise because the relator was not an agent of the federal government. Defendant maintained that the relator was only a licensee of the federal government and, as such, amenable to a state's special franchise tax. The New York supreme court held that a foreign company was not exempt from a state's special franchise tax because it held a federal license. (Quesada-Florida)
W71-02984

A CRITIQUE OF FEDERAL WATER RESOURCES POLICIES: HYDROELECTRIC POWER VERSUS WILDERNESS WATERWAY ON THE UPPER MISSOURI RIVER,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 06B.
W71-03016

PEOPLE EX REL LEHIGH VALLEY RR V STATE TAX COMM'N (NATURE OF RAILROAD'S RIGHT TO CROSS NAVIGABLE STREAMS).

220 App Div 1, 220 NYS 467-469 (1927).

Descriptors: *New York, *Navigable rivers, *Ownership of beds, *Easements, Navigable waters, Streams, Legal aspects, Judicial decisions, Beds, Taxes, Cities, Dredging, Railroads, Bridges, Construction.

Plaintiff state of New York, on the relation of a railway company, sought to exclude from taxation as special franchise several of the company's bridges across two streams. Relator railroad claimed that the streams were not navigable, that it owned the beds of the streams, and as a result that it was not subject to taxation on its bridges. The trial court found that the railway's bridges were taxable, and the New York supreme court affirmed. The lower court was correct in finding the streams navigable. As such, there existed an easement in the public to use the stream as a highway. Being a public highway, a franchise was necessary to cross. Moreover, relator's alleged ownership of the streambeds could not be determinative of the issue of taxation in any event. Ownership of the bed of a public stream is not ownership of the stream but of a property right subject to the easement in the public. Relator's right to cross these streams did not rest in ownership of the beds but was conferred by its charter of incorporation. Thus, it was a franchise and taxable even if relator did own the streambeds. Relator further contended that the streams were not navigable until dredged and that its bridges were constructed before the dredging. This contention, the court held, was not supported by the evidence. (Duss-Florida)
W71-03019

PEOPLE EX REL GRAND TRUNK RY V GILCHRIST (TAXATION OF RAILROAD COMPANY OPERATING OVER NAVIGABLE STREAM).
221 NYS 613-619 (1927).

Descriptors: *New York, *Navigable rivers, *Taxes, *Bridges, Assessments, Railroads, Engineering structures, Construction, Judicial decisions, Legal aspects, Right-of-way, Leases, Contracts, Governments, State governments, Navigation, Navigable waters.

Under authorization from the state, New York and Canadian corporations erected and owned a two level suspension bridge crossing the Niagara River. Plaintiff railroad company leased the upper deck of the bridge and was obliged to furnish the rails, ties and other track equipment. Defendant state tax commission assessed the railroad company for operation of a special franchise. Plaintiff sought review of the special franchise tax assessment. Plaintiff claimed it derived its right to cross the river on the bridge under its leases from the bridge companies. Defendant contended: (1) that plaintiff's rights came from the state; (2) that plaintiff owned tangible property on the top floor of the bridge; and (3) that use of such property over a navigable stream for railroad purposes constituted a special franchise which was taxable. The court reversed the trial court's judgment for plaintiff. The court held that plaintiff, in operating its railroad over a navigable stream and using its own tangible property on the bridge structure, was liable for taxation of a special franchise. The court also stated that the Niagara River was of navigable character even though at the point of the bridge, because of the proximity of rapids, the river was not navigable in fact. (Powell-Florida)
W71-03022

BOARD OF HUDSON RIVER REGULATING DIST V FONDA, J AND G RR (TAKING OF PROPERTY TO REGULATE RIVER FLOW FOR PUBLIC BENEFIT).
223 App Div 358, 228 NYS 686-701 (1928).

Descriptors: *New York, *Condemnation, *Flood control, *Public benefit, Eminent domain, Railroads, Right-of-way, Navigable waters, Rivers, Judicial decisions, Legal aspects, Reservoirs, Drainage systems, Flow control, Flood protection, Public health, Water management (Applied).
Identifiers: *Constitutions.

Plaintiff river-regulating district was created under a conservation law for the purpose of establishing a reservoir in drainage areas to regulate the flow of a river. Defendant railroad company owned land within the district. Plaintiff condemned defendant's land and defendant appealed the damage awards. Defendant contended that, since 95 per cent of the improvement assessments were paid by private beneficiaries, the primary purpose of the condemnation was a private purpose. Defendant claimed the primary purpose of the reservoir was the creation of power for private use. Defendant asserted that the taking of its property violated the commerce clause of the federal constitution. Plaintiff contended that regulation of river flow was the primary, amd public, purpose of the improvements. The New York supreme court held the condemnation proceedings were primarily for a public purpose, notwithstanding incidental private benefit. The condemnation of defendant railroad's right-of-way for the purpose of flood control was not an unconstitutional interference with interstate commerce. The court reasoned that incidental interference with interstate commerce, resulting from plaintiff's acts in protecting public health and welfare, was not repugnant to the commerce clause. (Powell-Florida)
W71-03026

BAY RIDGE DOCK CO V UNITED DRY DOCKS, INC (GRANTEE OF BOTTOMLAND MAY FILL IN TO BULKHEAD LINE).

146 Misc 404, 262 NYS 212-216 (S Ct 1932).

Descriptors: *New York, *Navigable waters, *Docks, *Ownership of beds, Beds, Channels, Bulkhead lines, Coastal structures, Legal aspects, Judicial decisions, Legislation, Governments, Admiralty, Harbors, Ships, Transportation, Public lands, Navigation.

Plaintiff dock company sought to enjoin defendant dock company from constructing a floating dry dock in the strip of open water between plaintiff's dock and defendant's dock. Although defendant held title to the bottomland upon which the dock was to be constructed, plaintiff maintained that defendant could not obstruct navigation. Plaintiff contended that it depended on the open water to dock vessels bringing cargo into its dock. Defendant contended that it had been granted title to the bottomland by the state and also the right to fill to the bulkhead line. The New York supreme court held that a state may make grants of lands under navigable waters for purposes useful to the public. Ownership of such lands includes the right to construct a pier or dock and to fill such land for the grantee's or the public's use. (Quesada-Florida)
W71-03030

UNITED STATES V WEST VIRGINIA (POWER OF THE UNITED STATES TO PREVENT CONSTRUCTION OF DAMS ON NAVIGABLE RIVERS).
295 US 463, 55 S Ct 789-793 (1935).

Descriptors: *Navigable waters, *Federal jurisdiction, State jurisdiction, *Hydroelectric project licensing, West Virginia, Dams, Federal government, State governments, Judicial decisions,

egislation, Damsites, Electric power, Beneficial se, Flood control, Legal aspects, Water resources evelopment, Federal Power Act, Projects, Project urposes, Navigation, Permits.

aintiff United States sought an injunction against efendant state to prevent the state from granting ermission for the construction of a dam on an in-rstate navigable river. Plaintiff contended that e river was navigable and therefore under the ntrol of Congress. Therefore, no dam which ould disrupt navigation or interfere with federal ojects could be authorized by defendant without ior Congressional approval. Defendant con-nded that the authorized dam would not interfere th navigation and that it could authorize such ojects as would improve navigation. Noting that ongress had absolute authority over navigable ers and potential obstructions to navigation, the preme Court of the United States nevertheless smissed the case for lack of a case or controversy thin the meaning of its original jurisdiction. aintiff had failed to allege actual or threatened in-rference. (Quesada-Florida)
71-03041

T HELEN SHOOTING CLUB V MOGLE (CONEYANCE OF HUNTING RIGHTS IN LAKE ND LAND SURROUNDING LAKE).
34 Mich 60, 207 NW 915-919 (1926).

escriptors: *Michigan, *Ownership of beds, Hunting, *Lakes, Shores, Wildlife, Fishing, Conacts, Easements, Land tenure, Marshes, Public ghts, Beds, Leases, Legislation, Judicial decisions, egal aspects.

aintiff sought to restrain defendants from infringg its hunting rights in a lake and in land surroundg the lake. Plaintiff's grantor had conveyed exclue hunting rights to plaintiff when grantor was wner in fee of all the land bordering the lake. Subquently, defendant purchased in fee a portion of e land bordering the lake. Subsequently, defenant purchased in fee a portion of the land borderg the lake, subject to the hunting privileges anted plaintiff. The trial court dismissed plainff's bill on the ground that the earlier conveyance as void as against public policy. The Michigan upreme Court reversed. An owner in fee of all nd bordering on a lake also owns the land under e lake. An owner in fee of shores and subaqueous nds has exclusive hunting privileges in those nds. Such owner may segregate the rights from e fee and convey them to one having no interest r ownership in fee, and such conveyances are not gainst public policy. Plaintiff's grantor, being posessed of exclusive hunting privileges, merely exersed a legal right in conveying them to plaintiff. Duss-Florida)
71-03049

AVANAUGH V BAIRD (DISPUTE OVER ITLE TO RELICTION ON LAKE HURON).
41 Mich 240, 217 NW 2-7 (1928).

escriptors: *Boundary disputes, *Michigan, Lake Huron, *Accretion (Legal aspects), State overnments, Administrative agencies, Land enure, Real property, Ownership of beds, Lakes, avigable waters, Meanders, Boundaries (Proper-), Docks, Easements, Legal aspects, Judicial ecisions.

laintiff riparian landowner brought action against efendant state commissioner to quiet title to a rection on Lake Huron. Plaintiff claimed title in fee o the reliction, whereas defendant asserted title in ne state in trust for the people. The court observed nat a riparian owner has a right of access to the avigable waters extending from the meander line, lthough the intervening space has become dry hrough reliction, but this right does not entitle the iparian owner to a fee title in the reliction. The ourt furthermore noted that plaintiff had the inefeasible right to wharf out to the navigable vaters. Determining that changes in the lakeshore by accretion and reliction do not affect the rights of riparian owners or the state, and that title to the lake bed was in the state when it was admitted to the Union, the court held title in defendant. The court rejected plaintiff's assertion that this holding violated the fourteenth amendment. (Hart-Florida)
W71-03050

SOO SAND AND GRAVEL CO V M SULLIVAN DREDGING CO (RIPARIAN OWNERS HAVE SOLE RIGHT UNDER STATUTE TO LEASE LAKE BED).
259 Mich 489, 244 NW 138-141 (1932).

Descriptors: *Michigan, *Leases, *Lake beds, *Riparian rights, Riparian land, Legal aspects, Judicial decisions, Damages, State governments, Administrative agencies, Legislation, Riparian waters, Lake Superior, Lakes, Public rights, Ownership of beds, Shores, Gravels, Mining, Dredging.

Plaintiff gravel company sued defendant dredging company for the value of gravel defendant had removed from the bed of Lake Superior in an area extending up to one mile from the shore of plaintiff's property. Defendant contended it had a valid lease from the state Department of Conservation. The Supreme Court of Michigan, in reversing a decision for defendant, held that the statute allowing the leasing of the lake bed up to one mile from shore or to the low water mark for mining purposes was limited exclusively to leasing to the riparian owner. The statute did not merely give him a preference over other lessees. If the owner did not choose to lease, neither he nor anyone else could take gravel or other material from the lake bed. The court found the statute was enacted to protect the riparian owners. Although the state holds title to lake beds in trust for the people, for purposes other than the trust, the state's right to use the beds is subordinate to that of the riparian owner. (Morris-Florida)
W71-03052

PEOPLE EX REL WESTERN, N Y AND PA RY V STATE TAX COMMISSION (STATUTE DECLARING RIVER NAVIGABLE DOES NOT LIMIT RIGHTS OF RIPARIAN OWNERS).
244 NY 596, 155 NE 911-912 (1927).

Descriptors: *Taxes, *New York, *Non-navigable waters, *Riparian rights, Judicial decisions, Legal aspects, Remedies, Legislation, Navigable rivers, Riparian land, Canals, Ownership of beds, Bridges, Railroads, Administrative agencies, Shores, Eminent domain.

Plaintiff railroad company sued defendant state tax commission to vacate three special franchise assessments based on plaintiff's erection of bridges across a river. Plaintiff contended the river was not navigable and that the shores and bed were privately owned. Thus, the right to erect the bridges did not constitute a special franchise. The state claimed the river was declared navigable by a state statute. The Court of Appeals of New York, in affirming a decision for plaintiff, held that the river, in the area between the bridges, was not navigable for any purpose. The statute purporting to declare it navigable was enacted after the state had parted with title to the shores and bed of the river. The state could not without compensation destroy the property rights of the riparian owners who had received the grants of title. Moreover, state acquisition of strips of the shore at a canal crossing could not make it a public navigable stream when it wasn't, in fact, navigable. (Morris-Florida)
W71-03059

PEOPLE EX REL LEHIGH VALLEY RY V STATE TAX COMM'N (STATE MAY ASSESS FRANCHISE OF BRIDGE OVER NAVIGABLE WATERS REGARDLESS OF WHETHER BED IS PRIVATELY OWNED).
247 NY 9, 159 NE 703-707 (1928).

Descriptors: *New York, *Bridges, *Navigable rivers, *Taxes, Railroads, Legal aspects, Judicial decisions, State governments, Federal governments, Ownership of beds, Shores, Streams, Boats, Legislation, Public rights, Administrative agencies, Navigation, Transportation, State jurisdiction.

Appellant railroad company sought to set aside an assessment on special franchises by respondent state tax commission. The assessment was for two bridges appellant had constructed over a river whose shores and bed it owned, but which was alleged to be navigable. Appellant asserted that since the bridge was constructed over its private property, it did not constitute a special franchise unless it actually interfered with public use of the stream. The Court of Appeals of New York, in affirming a judgment for respondent, held that the bridge was a special franchise even though it did not presently interfere with the small craft which used the river. The government's power to regulate rivers comes not from ownership but from its duty to maintain the avenues of commerce. A bridge is such a potential interference that Congress, or in its absence, the state, may regulate it. The perils caused by a bridge include not only obstruction to ships but the danger of items falling on craft below it. Even though the bridge here was constructed without governmental objection, the state may still assert its dominion. (Morris-Florida)
W71-03063

TEXAS AND PAC-MO PAC TERMINAL RR V W G COYLE AND CO (CONDEMNATION OF RIVERFRONT BATTURE).
159 La 1079, 106 So 571-574 (1925).

Descriptors: *Louisiana, *Eminent domain, *Condemnation, *Riparian land, Condemnation value, Local governments, Legislation, Land, Real property, Beds, Beds under water, Ownership of beds, Legal aspects, Judicial decisions, Adjudication procedure, Railroads, Mississippi River, Rivers, Banks, Shores, High water mark, Land tenure, Public rights.

Plaintiff railroad sought to expropriate land of defendant lying between a levee and the Mississippi River, sometimes submerged in high water, for the purpose of constructing an incline for passage of its cars onto a ferry. Defendant contended that: (1) article 14 of the Louisiana constitution limited expropriation of riverfront property to improvements thereon, and then only by order of the port authority; (2) plaintiff could not obtain complete title to the property; and (3) some of the property was in the bed of the river and not subject to private ownership. The Supreme Court of Louisiana affirmed a judgment for plaintiff. The provisions of article 14 did not deal with the power of eminent domain in general, but merely with the authority of the governing authority of the riverfront and did not limit the general power of condemnation. The court stated that the fact that plaintiff might not gain complete title, as riverfront owners are subject to regulation by the port authority, was not defendant's concern. If the property was not subject to private ownership, plaintiff would be paying something for nothing, but this too was not defendant's concern. Finally, the court stated that batture land, even if submerged during high water, is a continuation of the soil of the shore and belongs to the riparian owner. (Dye-Florida)
W71-03065

ELLERBE V GRACE (CONVEYANCE BY STATE OF DRY BEDS FORMERLY UNDER NAVIGABLE WATERS).
162 La 846, 111 So 185-187 (1926).

Descriptors: *Louisiana, *Dry beds, *Ownership of beds, *Land tenure, Beds under water, Lakes, Land, Real property, Legislation, State governments, Federal government, Legal aspects, Judicial decisions, Adjudication procedure, Lake beds, Navigable waters, Swamps, Public lands.

Plaintiffs sought to enjoin defendant register of the state land office from disposing of lands claimed by plaintiffs under conveyances from a state levee board. The land was once beneath the surface of a navigable lake, since dried up. The Supreme Court of Louisiana held for plaintiffs. Lands under navigable waters belong to the state. When navigable lakes dry up, the uncovered beds remain the property of the state. Act Number 74 of 1892 had granted plaintiffs' predecessor in title, the levee board, all state lands, however acquired, within the county. The levee board had conveyed the lands to plaintiffs' predecessor, and they to plaintiffs. State officers were estopped from asserting title to land conveyed by statute to the levee board, as against grantees from the board. (Dye-Florida)
W71-03066

NEW ORLEANS LAND CO V BOARD OF LEVEE COMM'RS OF ORLEANS LEVEE DIST (PROFIT FROM CONDEMNATION PROCEEDINGS).
171 La 718, 132 So 121-124 (1930).

Descriptors: *Louisiana, *Condemnation, *Condemnation value, *Public benefits, Legal aspects, Right-of-way, *Compensation, Judicial decisions, Adjudication procedure, Land, Real property, Lakes, Erosion, Beds, Lake beds, Navigable waters, Beds under water, Levees, Landfills, Land reclamation, Land development, Eminent domain.

Several years before the institution of the instant action, defendant levee district had obtained a right-of-way from plaintiff's predecessor in title for the purpose of constructing a levee. After construction of the levee, plaintiff's property abutting Lake Pontchartrain and outside the levee was eroded, much of it becoming lake bottom. The land in dispute in the instant case included land under water and what remained of the shore. Defendant levee district sought to take this land and reclaim it for residential purposes. Plaintiff contended that: (1) it was entitled to compensation for all the original land, including that under water; and (2) defendant was not constitutionally authorized to condemn land which it later intended to sell for pecuniary gain. The Supreme Court of Louisiana affirmed a judgment condemning the land and compensating plaintiff only for land above the high water mark. Bottoms of navigable waters are owned by the state to the high water mark. Defendant's purpose was the public benefit. The fact that some profit might accrue to the levee board did not invalidate the condemnation. (Dye-Florida)
W71-03068

PIZANIE V GAUTHREAUX (MEANING OF 'RIVER BANKS' IN DETERMINING EXTENT OF PUBLIC USE).
173 La 737, 138 So 650-652 (1931).

Descriptors: *Louisiana, *Banks, *Access routes, *Public rights, Navigable rivers, High water mark, Low water mark, Riparian land, Riparian rights, Riparian waters, Rivers, Navigable waters, Land tenure, Judicial decisions, Legislation, Legal aspects, Relative rights.

Plaintiff sought to enjoin defendant from trespassing upon a strip of plaintiff's property between a public road and the banks of a navigable river. Defendant contended that by statute the banks of navigable rivers were preserved for the use of the public, even though ownership was in a riparian owner. Defendant, in using the strip as an access route to a wharf, contended that as a member of the public he was making legitimate use of the bank. The court held that 'river bank', as used in the statute, meant the lands lying between the high water mark and low water mark of a river. So interpreted, the court held that the strip of land involved was not part at the bank of the river. Defendant was thus enjointed from trespassing upon the strip of land. (Snow-Florida)
W71-03073

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME I. LEGAL STUDY.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-188 061, $3.00 in paper copy, $0.95 in microfiche. October 1969, various pagings.
Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Money, Labor, Classification, Identification, Minerals, Irrigation systems, Patents, Control, Standards, Deserts, Reclamation, Budgets, Soils, Forestry, Feasibility studies, Management planning, Homestead Acts.

Review and analysis of the existing system of laws and policies for the disposal of agricultural lands for intensive agricultural purposes. The homesteading of public lands under the General Homestead Laws, Special Homestead Laws, The Desert Land Act. The Indian Homestead and Allotment Laws, Acreage limitation policies. The classification laws and their effect on disposal of land for agricultural use. Agricultural use of federal land by lease or permit and a comparative review of laws governing the disposal or lease of agricultural lands by various states (Agricultural use of land under the Administrative Jurisdiction of various Federal Agencies by lease or permit. A comparative Review of Laws providing for the disposal or lease of agricultural lands by various States). Problems and alternatives. (See also W71-03079)
W71-03078

REGIONAL AND LOCAL LAND USE PLANNING VOLUME IV.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-03079

TOWN OF NAPOLEONVILLE V BOUDREAUX (RIPARIAN OWNER PRECLUDED FROM BUILDING ON BANK OF NAVIGABLE STREAM).

142 So 874-876 (Ct App La 1932).

Descriptors: *Louisiana, *Streams, *Boundaries (Property), *Banks, Navigable waters, Riparian land, Riparian waters, Riparian rights, Boundary disputes, Land tenure, Legal aspects, Judicial decisions, Public lands, Local governments, Public rights, Real property, Buildings, Beds, Ownership of beds, Bayous, Roads, Cities, Accretion (Legal aspects).

Plaintiff town sued to enjoin defendant property owner from erecting a building on the bank of a navigable stream. Defendant's property and the stream were separated by a public street. Plaintiff contended that the bank was public property and that defendant was a mere squatter. Defendant contented that his deed conveyed title not only up to the street but also whatever title his grantor had to the batture land on the bank. Affirming a judgment for plaintiff, the court noted that, although the originators in title did own the bank, defendant's grantor did not receive the bank from his grantor and therefore had nothing to convey to defendant. The court also noted that, even if defendant did own the bank, the bank of a navigable stream is part of the public domain, and a riparian owner cannot appropriate it to private use by constructing buildings thereon. (Liptak-Florida)
W71-03094

SEIBERT V CONSERVATION COMM'N (LOCATION OF LOW WATER MARK AS DETERMINING BOUNDARY BETWEEN BATTURE AND RIVER BED).
181 La 237, 159 So 373-377 (1935).

Descriptors: *Louisiana, *Accretion (Legal aspects), *Low water mark, *Boundaries (Property), Riparian rights, Riparian land, Riparian waters, Ownership of beds, Beds, Banks, Mississippi River, Navigable rivers, River beds, Streams, Boundary disputes, Legal aspects, Judicial decisions, Land tenure, Real property, High water mark, Levees, Administrative agencies, State governments, Remedies, Leases, Gravels.

Plaintiff riparian owner sued defendant state conservation commission to quiet title to property fronting the Mississippi River, to enjoin defendant and its lessee, a gravel company, from trespassing on the property, and to recover rent collected by defendant. Plaintiff contended that the property was batture or accretion to his property, the low water mark being determined according to the state river commission by the average of the lowest annual water for 43 years. Defendant contended that the suit could not be maintained, since it was against the state, and that the property was not batture but a part of the river bed, the low water mark being determined according to the state board of engineers by the average of the lowest daily low water for 43 years. Affirming a judgment for plaintiff, the court noted that defendant was an independant political corporation and could sue or be sued on its own behalf. Without deciding which method of locating the low water mark was correct, the court relied on lay testimony establishing that the sand and gravel was taken from land which was out of the water during the entire low water season. The property was batture land and part of the bank rather than part of the river bed. (Liptak-Florida)
W71-03110

CHINN V PETTY (NO PRIVATE RIGHT TO CONSTRUCT BUILDING ON BANK OF NAVIGABLE STREAM).
163 So 735-736 (Ct App La 1935).

Descriptors: *Louisiana, *Navigable waters, *Buildings, *Banks, Streams, Boundaries (Property), Bayous, Beds, Accretion (Legal aspects), Riparian land, Riparian waters, Riparian rights, Boundary disputes, Land tenure, Legal aspects, Judicial decisions, Public land, Public rights, Real property, Relative rights.

Plaintiff owned a house which he had built on the bank of a navigable stream with the permission of the bank's owner, defendant's predecessor in title. Defendant evicted plaintiff and removed plaintiff's furnishings, whereupon plaintiff brought action against defendant to recover damages for loss of use of the premises, humiliation, value of the house, and damages to the furnishings. Plaintiff contended that although the banks of navigable streams are reserved to the use of the public, ownership is in the adjacent landowner, who in this case granted plaintiff permission to build the house. Affirming a judgment for defendant, the court held that plaintiff was a mere licensee and that none of his rights had been invaded. The court noted that the use of the bank was open to plaintiff as a member of the public, but he could not appropriate it to private use by the construction of a permanent building. (Liptak-Florida)
W71-03129

GREISINGER V KLINHART (PRESCRIPTIVE RIGHT TO MAINTAIN WATER LEVEL IN ARTIFICIAL LAKE FOR FISHING CAMP).
282 SW 473-478 (Mo 1926).

Descriptors: *Missouri, *Lakes, *Recreation facilities, *Prescriptive rights, Dams, Streams, Reservoirs, Reservoir operation, Non-navigable waters, Public rights, Camp sites, Boating, Fishing, Swimming, Legal aspects, Boundaries (Property), Judicial decisions, Navigation, Riparian rights, Water levels.

Plaintiff owned a fishing camp on a lake formed by defendant's dam across a non-navigable stream flowing through plaintiff's and defendant's property. Plaintiff sued to restrain defendant from lowering the water level in the lake and from maintaining a fence across the lake on the property line,

hereby injuring plaintiff's business. Plaintiff contended that he had a prescriptive right to the maintenance of the water level in the lake and that the lake had been dedicated to the public since it had formerly been open to the public without charge and had been stocked with fish by the state. Reversing a judgment for plaintiff, the court first held that the stream was non-navigable, since it was not susceptible to use for commerce in its ordinary condition. The court then found that plaintiff had no prescriptive rights in the lake since he had not exercised any rights for 10 years, could not count the time the property was owned by the common grantor, and his use was not an adverse use. Finally, the court held that there could be no implied dedication of the lake without a showing of a clear intent on the part of the owner to dedicate the lake to the public. (Liptak-Florida)
W71-03187

FINANCING WATER SUPPLY AND SEWERAGE PROJECTS IN DEVELOPING COUNTRIES,
International Bank for Reconstruction and Development, Washington, D.C.
For primary bibliographic entry see Field 06C.
W71-03218

DUMM V COLE COUNTY (TITLE TO ACCRETIONS IN NAVIGABLE RIVER).
287 SW 445-450 (Mo 1926).

Descriptors: *Missouri, *Accretion (Legal aspects), *Boundaries (Property), *Navigable rivers, Missouri River, Rivers, Islands, Real property, Boundary disputes, Land tenure, Low water mark, Surveys, Mapping, Legal aspects, Judicial decisions, Riparian land, Remedies, Adjudication procedure, Local governments, Sand bars, Dikes, Flood protection.

Plaintiff riparian owner brought action against defendant county to quiet title to certain property on a navigable river and to enjoin defendant from selling the property pending determination of ownership. Plaintiff contended that the land was formed by accretions to his land was formed by accretions to his land and was therefore his property. Defendant contended that the land was not an accretion to plaintiff's land, but rather was formed as an island in the river and gradually extended to plaintiff's land. Therefore, the land belonged to the county. Defendant also argued that plaintiff's land was agri limitati, strictly limited to the metes and bounds described in the conveyance, and was not entitled to rights of accretion. The court held that the evidence sufficiently supported the lower court's judgment for plaintiff and affirmed the judgment. The court also noted that plaintiff's land was not agri limitati since the survey of the land was to the low water mark even though it was described by metes and bounds. (Liptak-Florida)
W71-03225

DAMS AND SPILLWAYS (PROCEDURES FOR INITIATING CONSTRUCTION OR ALTERATION).
Iowa Code Ann, secs 112.1-112.10 (1949) as amended (Supp 1970).

Descriptors: *Iowa, *Dams, *Spillways, *Administrative agencies, Streams, Lakes, Civil engineering, Costs, Damages, Compensation, Public benefits, Water levels, Riparian land, Judicial decisions, Decision making, Administration, Legislation.

Whenever the state conservation commission believes that it is necessary to erect a dam or spillway, or alter an existing dam or spillway, the commission must adopt a resolution of necessity, describing generally the contemplated work. Subsequently, a competent civil engineer shall prepare a detailed plan showing: (1) work contemplated, (2) effect upon water level, and (3) probable cost. The commission may tentatively approve this plan. Claims for damages by the proposed project shall be filed with the commission prior to a hearing to be held with notice. The plan may be adopted at the hearing or may be modified if adverse effects to riparian owners are not worsened thereby. Damages will be appraised by three disinterested appraisers. At hearing, the commission shall determine the amount due each claimant. The appraiser's report may be followed in the commission's discretion. (Hart-Florida)
W71-03227

EX PARTE KELLER (BOUNDARY DISPUTE OVER SWAMPLAND).
199 SE 909-917 (SC 1938).

Descriptors: *South Carolina, *Boundary disputes, *Swamps, *Boundaries (Property), Land tenure, Real property, Non-navigable waters, Judicial decisions, Legal aspects, Streams.

Plaintiff landowner sued defendant landowner to obtain possession of land. Plaintiff purchased land which had been previously owned by defendant and his deceased brother as tenants-in-common. The land bordered upon a swamp. Defendant purchased land on the other side of the same swamp; this tract had also been previously owned by defendant and his brother. A creek, the common boundary of the two tracts, passed through the swamp. When defendant and his brother had owned both tracts, a highway was constructed through the swamp, altering the creek's course. Defendant had acquiesced in this alteration. Defendant claimed title to the old creek thread, while plaintiff claimed title to the new creek. The court stated that absent an expressed contrary intention, title to land on a swamp runs to the swamp's creek's thread. The Supreme Court of South Carolina stated that where one person owns two tracts and changes the common boundary, a later conveyance of one will be presumed to be to the boundary existing at the time of the conveyance. The court held for plaintiff. Defendant was presumed by his acquiescence to have intended to alter the boundary. (Hart-Florida)
W71-03228

CURRY V CRULL (OWNERSHIP OF ACCRETED ISLAND IN MISSOURI RIVER).
116 SW2d 125-128 (Mo 1938).

Descriptors: *Missouri, *Islands, *Land tenure, *Accretion (Legal aspects), Boundaries (Property), Real property, Missouri River, Navigable rivers, Navigable waters, River flow, Judicial decisions, Legal aspects.

Plaintiff riparian landowner sued to quiet title and to eject defendant interlopers from an island in the Missouri River. Defendants contended that the disputed land formed as an island, whereas plaintiff asserted that the land had originally accreted to his land and that later the River had cut the disputed land off to form an island. Reviewing the evidence, the court held that it supported the lower court's decision for plaintiff. Plaintiff held title in the island by accretion. (Hart-Florida)
W71-03229

SCHLICHTRULL V MELLON-POLLOCK OIL CO (NEGLIGENT DRILLING OF OIL WELL ALLEGED TO HAVE CAUSED SALINE WATER INTRUSION).
301 Pa 553, 152 A 829-831 (1930).

Descriptors: *Pennsylvania, *Saline water intrusion, *Oil wells, *Water wells, Groundwater, Saline water-fresh water interfaces, Mixing, Penetration, Drill holes, Groundwater movement, Damages, Legal aspects, Compensation, Brines, Water supply, Boundaries (Surfaces), Well casings, Saline water, Wells, Seepage, Damages, Remedies.

Plaintiff farmowner sued defendant oil well lessee for damages caused by pollution of plaintiff's well. Defendant had encountered salt water in drilling, and because defendant had failed to drive casings to prevent intrusion of the salt water into the fresh water strata lying above, the salt water seeped into plaintiff's well. The court noted that without negligence no liability inures for interference with subterranean waters. However, defendant was liable because it had failed to exercise due care. Defendant asserted that the oil well was to be abandoned in six months and that, therefore, the injury was temporary. Plaintiff asserted that the injury was permanent, since defendant had not proven that plugging the well would prevent salt water intrusion or restore the property to its original condition. Holding that the injury was permanent, the court affirmed the trial court's measure of damages based upon the diminution in market value of plaintiff's tract. (Hart-Florida)
W71-03230

NATHANSON V WAGNER (ALTERED FLOW OF SURFACE RUNOFF ALLEGED TO HAVE DAMAGED DOWNHILL LANDOWNER).
179 A 466-470 (Ch NJ 1935).

Descriptors: *New Jersey, *Repulsion (Legal aspects), *Surface runoff, *Alteration of flow, Riddance (Legal aspects), Surface waters, Diversion, Relative rights, Drainage water, Legal aspects, Judicial decisions, Overflow, Damages, Slopes, Obstruction to flow, Flood damage, Structures, Barriers, Surface drainage, Buildings.

Plaintiff landowner sought damages and an injunction to prevent defendant contiguous landowner from discharging surface water into his building. The rear of defendant's lot was covered by concrete and cinders and sloped towards plaintiff's lot. Plaintiff alleged that surface water falling upon defendant's building flowed to the rear of defendant's lot, accumulating there with other water to flow into plaintiff's basement, injuring the building foundation. The court defined surface waters as those falling by precipitation or rising from springs. Such waters follow no defined course on land and are lost by diffusion. Stating the common enemy rule that, even though injury ensues, any owner may repulse surface water by any means without liability. The court also noted an exception. A landowner cannot, to his neighbor's injury, artificially alter the natural flow of surface water by accumulating it in artificial channels and augmented quantities. However, because water also flowed onto plaintiff's land from other sources, the court determined that the flooding was not caused by such a wrongful accumulation on defendant's property. Defendant was not liable. (Hart-Florida)
W71-03231

DYKSTRA V DARLING (DRAINAGE RIGHTS OF ADJACENT PROPERTY OWNERS).
150 A 78-79 (RI 1930).

Descriptors: *Rhode Island, *Obstruction to flow, *Natural flow, Drainage, Natural flow doctrine, Ditches, Dams Damages, Dikes, Outlets, Drainage water, Overflow, Channel improvement, Judicial decisions, Legal aspects, Surface waters, Relative rights.

Plaintiff landowner sought to restrain defendant contiguous landowner from maintaining a dam obstructing the natural drainage from plaintiff's tract. A pond on plaintiff's land drained in two directions, flowing in one ditch across plaintiff's land. Defendant contended that this ditch had been dug by his predecessor in title and that therefore he had a right to dam it. Plaintiff asserted that it was a natural watercourse. Defendant further asserted that the pond drained primarily through the other outlet, only draining through the disputed watercourse at extremely high water. The lower court found that the pond drained primarily through the disputed watercourse and that this watercourse was natural, even though it had been cleared and enlarged by defendant's predecessor. However, the appellate court observed that defendant's

predecessor had left a small section of the ditch in its natural state. This section had been dug out by plaintiff so that plaintiff was obtaining drainage in excess of natural drainage. Accordingly, the injunction granted by the lower court was modified to provide plaintiff with only natural drainage. (Hart-Florida)
W71-03232

CITY OF PHILADELPHIA V PHILADELPHIA SUBURBAN WATER CO (COMPETING USES OF LIMITED RESOURCES).
309 Pa 130, 163 A 297-303 (1932).

Descriptors: *Pennsylvania, *Consumptive use, *Preferences (Water rights), *Condemnation, Cities, Water resources development, City planning, Urbanization, Legislation, Competing uses, Equitable apportionment, Local governments, Prior appropriation, Water allocation (Policy), Measurement, Water supply, Water utilization.

Plaintiff city sought to enjoin defendant water company from condemning water in a tributary of the river from which plaintiff obtained its water. Defendant sought to condemn 10 million gallons/day. Plaintiff's requirements were 200 million gallons/day. Plaintiff obtained its right to consume water by legislation before defendant obtained condemnation authority. The court noted that since a navigable river is held for public benefit, it is public property and not subject to eminent domain, although the sovereign may grant rights in a navigable river not interfering with navigation. Plaintiff's grant was found to authorize the taking of a reasonable amount of water. Since defendant's claim was junior to plaintiff's, defendant was enjoined from taking water which would prevent plaintiff from obtaining sufficient water to meet its requirements. Although defendant contended that plaintiff wasted water by failure to meter and by opening hydrants in the summer, since plaintiff was converting to a metered system, the court determined that these practices were not wasteful. The court noted that even plaintiff's right of consumption was subject to the public's navigation rights. (Hart-Florida)
W71-03233

BOYCE COTTONSEED OIL MFG CO V BOARD OF COMM'RS (CONDEMNATION VALUE OF LAND AND MILL TAKEN FOR LEVEE).
107 So 506-511 (La 1926).

Descriptors: *Louisiana, *Levees, *Riparian land, *Condemnation value, Riparian rights, Banks, Public rights, Eminent domain, Condemnation, Compensation, Damages, Mills, Assessments, Taxes, Local governments, Legislation, Flood protection, Legal aspects, Judicial decisions.
Identifiers: Levee districts.

Plaintiff mill owner sued defendant levee district to recover the condemnation value of land and a mill located on the bank of a river. Defendant had built a levee which left plaintiff's property between the levee and the river. Plaintiff contended that, under applicable statutes, the land and mill should be considered taken or destroyed for levee purposes and that plaintiff was entitled to compensation for the full value of the land and mill. Defendant contended that plaintiff had sold the mill for its full value and therefore had suffered no injury, that the value of the mill was limited to the assessed rather than the actual value, and that plaintiff's land was batture land or public bank and could be taken without compensation. The Supreme Court of Louisiana found that plaintiff's land was not batture land since it was not submerged at ordinary high water and was not public bank since it was outside municipal limits. The court affirmed that part of a lower judgment compensating plaintiff for the land but reversed an award of damages for the mill. The court held that the value of the mill was limited to the assessed value, and plaintiff had received more than that amount from the sale of the mill. Three judges dissented on the ground that the assessed value merely limited the amount of compensation, not the value of the property. (Liptak-Florida)
W71-03234

CITIZEN'S HARDWARE AND FURNITURE CO V CHICAGO, ROCK ISLAND AND PACIFIC RY (PROXIMATE CAUSE OF FLOODING MUST BE PROVEN BY PLAINTIFF).

125 So 299-300 (La 1929).

Descriptors: *Louisiana, *Surface drainage, *Culverts, *Flooding, Flood damage, Legal aspects, Judicial decisions, Damages, Local governments, Railroads, Embankments, Surface water, Drainage, Natural flow, Surface runoff, Remedies, Adjudication procedure.

Plaintiff store owner sued defendant railroad company for damages suffered in the flooding of his store. Plaintiff alleged that the flooding was caused by defendant's negligent construction of culverts under a roadbed of defendant. Defendant denied the roadbed or culverts caused the flooding. The Court of Appeal of Louisiana, in affirming a decision for defendant, held that plaintiff had not met the burden of showing defendant's actions were the cause of his damage. Indeed, the evidence showed that plaintiff's building was below the level of the surrounding land and that water naturally gravitated toward it. Other evidence showed that any of several things, including the closing of a culvert by a town, could have caused the flooding . There was no proof that defendant's actions or failure to act caused the damage. (Morris-Florida)
W71-03235

PACIFIC SPRUCE CORP V CITY AND COUNTY OF SAN FRANCISCO (MUNICIPALITY'S LIABILITY FOR SHIP COLLISION WITH BRIDGE).
72 F2d 712-714 (9th Cir 1934).

Descriptors: *Bridges, *Cities, *Ships, *Admiralty, Accidents, Damages, Hazards, Abutments, Piles (Foundations), Permits, Administrative agencies, Judicial decisions, Legal aspects, Adjudication procedure, Damages, Remedies.

Plaintiff corporation brought libel against defendant city for injury sustained by plaintiff's vessel while passing through defendant's bridge. The vessel was being towed backwards through the drawbridge, and by plaintiff's inadvertence the tug required to keep the vessel's bow straight was not secured. When the vessel passed through the drawbridge, the bow swung and the vessel's mast struck the drawbridge overhang. Defendant had previously removed a dolphin which would have prevented the vessel from swinging far enough to strike the overhang. Plaintiff contended that defendant had negligently removed the dolphin and that the bridge was a navigational obstruction not authorized by the Secretary of War. Defendant asserted that plaintiff's negligence was the cause of the injury and, therefore, that it was not liable. The court held that the cause of the accident was the master's negligence in failing to control the bow. Moreover, plaintiff had not proven that defendant's acts so materially contributed to the collision as to require an apportionment of the damages. Defendant's failure to obtain a permit from the Secretary of War was immaterial. (Hart-Florida)
W71-03236

NEBRASKA V WYOMING (EQUITABLE APPORTIONMENT OF WATER RIGHTS IN INTERSTATE RIVER).
295 US 40, 55 S Ct 568-570 (1935).

Descriptors: *Equitable apportionment, *Interstate rivers, *Prior appropriation, *Preferences (Water rights), Nebraska, Wyoming, United States, Nonnavigable waters, Appropriation, Water rights, Legal aspects, Judicial decisions, Diversion, Diversion structures, Dams, Federal government Federal reclamation law, State governments, Wate allocation (Policy).

Plaintiff Nebraska sued defendant Wyoming t ascertain and enforce an apportionment of th waters of an interstate non-navigable river. Plaintif contended that defendant's citizens had diverte water in excess of their rights of appropriation, tha plaintiff's citizens' rights were prior in time, an that the United States had built a dam which als diverted water to plaintiff's injury. Defendan moved to dismiss and contended that plaintiff ha failed to join as indispensable parties Colorad through which the river flowed, and the Secretar of the Interior, who was in charge of the federa dam project. The Supreme Court noted that th missing parties were not indispensable since n claim was made against Colorado, and the Secreta ry of the Interior was bound by any decision as an other appropriator in Wyoming. The court denie the motion to dismiss. (Liptak-Florida)
W71-03237

BORAX CONSOL V CITY OF LOS ANGELE (FEDERAL VERSUS STATE TITLE TO SUB MERGED TIDAL LAND AND SHORELINE).
296 US, 10 56 S Ct 23-31 (1935).

Descriptors: *United States, *Ownership of beds *Tidal waters, *Coasts, California, Cities, Oceans Pacific Ocean, High water mark, Low water mark Land tenure, Legal aspects, State governments, Ju dicial decisions, Surveys, Mapping, Administrativ decisions, Beds, Shores, Tides.

Plaintiff city sued defendant corporation to quie title to property bounded by the Pacific Ocean Plaintiff contended that the property was tideland which passed to the state on its admission to th Union. Defendant, relying on a government surve and plat, contended that the property was uplan and claimed title under a patent from the Unite States. The Supreme Court noted that the finding of the government surveyor and land office wer not conclusive and that the proper boundarie should be determined by the courts after examinin all the evidence. Affirming the decree in favor o plaintiff, the court noted that the proper boundar between the tideland, which belonged to the state and the upland, which was public land and could b granted by the United States, was the mean hig water mark determined at mean high tide over period of years. (Liptak-Florida)
W71-03238

DUCK ISLAND HUNTING AND FISHING CLU V EDWARD GILLEN DOCK, DREDGE AN CONST CO (FEDERAL AND STATE AP PROVAL OF RIVER PROJECTS AS PREREQUISITE TO A VALID CONTRACT).
330 Ill 121, 161 NE 300-305 (1928).

Descriptors: *Illinois, *Rivers and Harbors Act *Levees, *Contracts, Drainage districts, Judicia decisions, Remedies, Legal aspects, Legislation Federal government, State governments, Adminis trative agencies, Navigable rivers, Streams, Naviga ble waters, Permits, Drainage, Channels, Natura flow, Construction, Drainage effects, Obstructio to flow, Alteration of flow, Dredging.

Plaintiff landowners sought dissolution of drainage district which had contracted with defen dant to construct a levee on the Illinois River. After the contract was signed, the district had modifie its plans to get approval from the Secretary of Wa and the state department of public works. Plaintiff petitioned for dissolution of the district, alleging that its benefits were not commensurate with the expense and asserting that defendant's contract was void in that it had been signed before the state and federal approval of the plans. Defendants contended that if the river was a stream within the meaning of the state statute and the Rivers and Harbors Act, approval was needed only before the work was begun, not before the contract was

gned. The Supreme Court of Illinois, in affirming decision for plaintiff, stated that the river was a avigable stream, that the work would narrow the ver and increase its flow, and that permits were eeded from both the state and federal governents. The court further held that the laws quired the granting of the permits before consuating the contract. The contract as executed was id. (Morris-Florida)
71-03239

HICAGO, ST L AND N O RR V BULLOCK IABILITY FOR FLOOD DAMAGE CAUSED Y OVERFLOW OF DRAINAGE DITCH OBTRUCTED BY RAILROAD EMBANKMENT).
2 Ky 10, 299 SW 1085-1089 (1927).

escriptors: *Kentucky, *Ditches, *Obstruction to ow, *Flood damage, Surface drainage, Drainage ater, Surface waters, Surface runoff, Damages, ailroads, Embankments, Culverts, Cloudbursts, ain water, Legal aspects, Judicial decisions, Adjucation procedure, Historic flood, Flooding.

aintiff farmer sued defendant railroad to recover r flood damage to his crops. The damage was used by the obstruction and overflow of a ainage ditch. Plaintiff contended that defendant's nbankment had filled in and blocked a ditch aining his land and that defendant had substan inequate ditch which was allowed to become obructed with weeds and debris. Defendant argued at the new ditch was more adequate than the old, at the flooding was caused by an extraordinary infall, and that the ditch was a permanent struce for which plaintiff could only recover the minution in the value of his land but not the value his crop. The Court of Appeals of Kentucky held at the lower court properly withdrew from the ry the question of the permanency of the ditch nce all of the evidence showed that the ditch uld be enlarged at a reasonable cost, thus making e measure of damages the same as in the case of a mporary structure. Affirming a judgment for aintiff, the court noted that the infrequent or exaordinary nature of the rainfall did not mean it ould not have been anticipated. (Liptak-Florida)
71-03240

TOUT LUMBER CO V REYNOLDS (TIMBER WNER'S LIABILITY FOR OBSTRUCTION OF TREAM BY TIMBER CUT BY INDEPENDENT ONTRACTOR).
SW2d 77-79 (Ark 1928).

escriptors: *Arkansas, *Flood damage, *Obstrucon to flow, *Lumbering, Water injury, Streams, reamflow, Natural flow doctrine, Alteration of ow, Riparian land, Riparian waters, Riparian ghts, Legal aspects, Judicial decisions, Adjudicaon procedure, Damages.

laintiff landowner sued defendant landowner to ecover damages for flooding of plaintiff's land aused by timber, cut from defendant's land, obructing the stream which flowed past the adjacent roperties. Plaintiff contended that he was entitled the natural flow of the stream and that defendant as liable for the flooding even though the work as done by an independent contractor. Defendant ntended that there was no liability since the work as done by the independent contractor and that ere would have been no flooding but for the conactor's negligence. Affirming a judgment for laintiff, the Supreme Court of Arkansas held that vidence was sufficient to sustain the jury's verdict. he contractor's foreman had stated that the mber could not be cut without some obstruction f the stream. (Liptak-Florida)
71-03241

ECK V STATE EX REL ATTNY GEN (RIPARIN RIGHT TO DRAIN LAKE TO MAINTAIN ATURAL WATER LEVEL).
4 SW2d 1101-1104 (Ark 1929).

Descriptors: *Arkansas, *Lakes, *Water levels, *Drainage systems, Levees, Dams, Drains, Ditches, Flood damage, Drainage effects, Repulsion (Legal aspects), Streams, Natural flow doctrine, Obstruction to flow, Riparian land, Riparian rights, Riparian waters, Legislation, Prescriptive rights, Public rights, Recreation facilities, Legal aspects, Judicial decisions, State governments, Outlets.

Plaintiff state sued to compel defendant riparian owners to dam a ditch they had dug to partially drain a lake. Plaintiff contended that lowering the water level of the lake would damage the value of the lake to the public for hunting and fishing and that the state had a prescriptive right to maintain the water level in the lake. Defendants contended that a state-built levee had raised the level of the lake to flood heights, thereby ineffectuating their drainage systems, flooding parts of their land, and causing other parts to wash away. Defendants argued that by means of the ditch they only sought to restore the natural level of the lake by restoring the natural drainage through a bayou. The Supreme Court of Arkansas noted that flood waters are a common enemy and that riparian owners have a statutory right to remove obstructions from natural streams and drains. Reversing a judgment for plaintiff, the court held that defendant's ditch served the purpose of clearing the obstructed bayou and restoring the natural drainage and water level. This was their statutory right. (Liptak-Florida)
W71-03242

REED V CULLOR (LIABILITY FOR CROP DAMAGE CAUSED BY OBSTRUCTION OF NATURAL STREAM FLOW).
32 SW2d 296-299 (Mo 1930).

Descriptors: *Missouri, *Obstruction to flow, *Floods, *Dams, Natural streams, Water injury, Streams, Riparian land, Riparian water, Riparian rights, Flood damage, Crop response, Overflow, Stream flow, Natural flow doctrine, Watercourses (Legal), Earth dams, Rainfall, Cloudbursts, Surface runoff, Damages, Water law, Legal aspects, Repulsion (Legal aspects), Judicial decisions.

Plaintiff landowner brought action against adjacent landowner to recover for flood damage to plaintiff's crops and pasture. The damage was allegedly caused when defendant dammed up a stream flowing through both properties. Plaintiff contended that defendant's dam obstructed the flow of two natural streams, causing one to overflow and destroy a crop and causing the other to flood a pasture, destroying its rental value. Defendant denied the obstruction and contended that plaintiff's land was lower than his, that the damage was caused by heavy rainfall, and that there were no natural streams on plaintiff's land but that plaintiff's land was already inundated with surface water. Affirming a judgment for plaintiff, the court noted that a stream still existed even though its water left the defined course temporarily and later returned to the stream. The jury, under proper instructions, had properly decided the issues in favor of plaintiff. (Liptak-Florida)
W71-03243

HENICLE V PENNSYLVANIA RR (REPULSION OF SURFACE WATER BY RAILROAD).
197 NE 360-362 (Ct App Ohio 1934).

Descriptors: *Ohio, *Repulsion (Legal aspects), *Riddance (Legal aspects), *Surface runoff, Drainage, Railroads, Legislation, Surface waters, Ditches, Water conveyance, Drainage practices, Runoff, Judicial decisions, Legal aspects, Relative rights.
Identifiers: *Injunction (Mandatory).

Plaintiff landowner sought a mandatory injunction to compel defendant railroad to maintain a ditch to drain his adjoining land. Plaintiff asserted that defendant had failed to comply with a statute requiring railroads to maintain ditches to effect natural drainage. The court stated the civil law rule that a lower landowner cannot alter the natural flow of surface water from higher land. The court determined from the evidence that defendant had violated both the statute and the civil law rule. The injunction was granted. (Hart-Florida)
W71-03244

CENTRAL MAIN POWER CO V ROLLINS (RIPARIAN OWNER OF BOTH BANKS ALSO OWNS RIVER BED AND ALL WATER RIGHTS).

138 A 170-175 (Me 1927).

Descriptors: *Maine, *River beds, *Ownership of beds, *Riparian rights, Navigable waters, Rivers, Streams, Banks, Beds, Riparian land, Riparian waters, Boundary disputes, Boundaries (Property), Land tenure, Real property, Prescriptive rights, Legal aspects, Judicial decisions, Water rights.

In plaintiff's suit to quiet title to riparian land on the south bank of a river, defendant set up as a defense adverse possession of the land on both sides of the river. Affirming a judgment for defendant, the court noted that, as the riparian owner of both banks, defendant's title extended to and included the bed of the stream and all water rights. (Liptak-Florida)
W71-03245

ATLANTIC-BRIGANTINE HOTEL AND PIER CO V ISLAND DEV CO (DEFINITION OF RIPARIAN RIGHTS CONVEYED BY DEED TO SEASHORE).
145 A 330-333 (Ch NJ 1929).

Descriptors: *New Jersey, *Seashores, *Riparian rights, *Right-of-way, Piers, Docks, Recreation facilities, Shores, Oceans, Atlantic Ocean, Riparian land, Riparian waters, Land tenure, Easements, Real property, Public rights, Banks, Legal aspects, Judicial decisions, Navigable waters, Usufructuary right, Severance, High water mark.

Plaintiff vendee sued defendant vendor to set aside a deed and a mortgage to ocean front property. Plaintiff contended that defendant had failed to convey the riparian rights on the ocean, as required by the purchase contract, and had fraudulently represented his ownership of those rights. In dismissing plaintiff's claim, the court noted that the contract called only for defendant's rights in the land below high water mark. Plaintiff knew that defendant did not own any riparian rights in the ocean but only the right to obtain those rights from the riparian commissioners. (Liptak-Florida)
W71-03246

DONAHUE V CONANT (LOW WATER MARK AS LIMITING RESTRICTIVE COVENANT IN DEED TO RIPARIAN PROPERTY).
146 A 417-419 (Vt 1929).

Descriptors: *Vermont, *Lakes, *Low water mark, *Boundaries (Property), Riparian land, Riparian waters, Piers, Lake shores, Shores, Legal aspects, Judicial decisions, Real property, Easements, Land tenure, Recreation facilities.
Identifiers: Restrictive covenants.

Plaintiff riparian owner sued to enjoin defendant riparian owner from selling sodas and hot dogs in violation of a covenant in a deed from plaintiff's predecessor to defendant's predecessor. Plaintiff contended that the deed forbade the operation of any restaurant on the property and that defendant had several concession stands on the property and on a pier built out from the property over the lake shore. Reversing a decree in favor of plaintiff, the court noted that a deed to land on a public lake passes title only to the low water mark. Therefore, the concession stand on the pier, being beyond the low water mark, was not prohibited by the covenant. The court also held that the isolated sales of a few items could not be considered the 'business' of

operating a restaurant. Such sales did not violate the covenant. (Liptak-Florida)
W71-03247

NASHA HOLDING CORP V RIDGE BLDG CORP (RIPARIAN TITLE EXTINGUISHED BY SUBMERGENCE).

221 App Div 238, 223 NYS 223-231 (1927).

Descriptors: *New York, *Boundaries (Property), *Riparian land, *Submergence, Beds, Land tenure, Real property, Riparian rights, Shores, Beaches, High water mark, Legal aspects, Judicial decisions, Contracts.

Plaintiff developer brought action against defendant riparian owner to recover a down payment and to cancel a sale of riparian land. Plaintiff contended that defendant's title was unmarketable because defendant's grantor had retained a 4-foot strip between the high water mark and the conveyed property. Defendant contended that his grantor's 4-foot strip had been lost by submergence and that the grantor's claim was not a cloud on the title. Reversing a judgment for plaintiff, the court held that submergence extinguishes ownership of riparian land and that defendant, although not the orginal riparian owner, was now the riparian owner with all riparian rights. Since the 4-foot strip had been lost by submergence, defendant's grantor had no claim against defendant's title. (Liptak-Florida)
W71-03248

BOARD OF SUP'RS V WATER POWER AND CONTROL COMM'N (REVIEW OF ORDER AUTHORIZING NEW MUNICIPAL WATER SUPPLY).
227 App Div 345, 238 NYS 55-61 (1929).

Descriptors: *New York, *Water supply, *Municipal water, *Administrative decisions, Potable water, Dams, Reservoirs, Water demand, Administrative agencies, Water policy, Water consumption, Legal aspects, Judicial decisions, Eminent domain, Condemnation, Cities, Local governments.

Plaintiff county board of supervisors sought review of an order of defendant state water commission. The order authorized a city to condemn certain property to be used as an additional water supply. Plaintiff contended that the order was arbitrary and unreasonable since a more suitable, more efficient, and less expensive water supply could be obtained from another source without damaging plaintiff's property. Defendant contended that it lacked authority to choose between the site selected by the city and another site. The court held that defendant did have authority to approve a site different from that selected by the city. However, the defendant had already determined that the proposed site would provide the best water supply for the least cost. The order was affirmed. (Liptak-Florida)
W71-03249

OYSTERMEN'S DOCK CO V DOWNING (VALIDITY OF LEASE OF TIDAL BOTTOM).
137 Misc 376, 241 NYS 675-676 (1930).

Descriptors: *New York, *Beds, *Leases, *Cities, Bays, Ownership of beds, Local governments, Public rights, Public lands, Tidal waters, Navigable waters, Legal aspects, Judicial decisions, Administrative decisions, Legislation, State governments.

Plaintiff dock company sued to compel defendant town supervisor to execute a lease of land under water owned by the town, which lease had been approved by the town council but opposed by public referendum. The court held that defendant's signature on the lease was a mere ministerial act and must be compelled in the absence of fraud in securing the lease. (Liptak-Florida)
W71-03250

IN RE PUBLIC BEACH IN CITY OF NEW YORK (CONDEMNATION VALUE OF OCEAN-FRONT RIPARIAN RIGHTS).
230 App Div 407, 245 NYS 121-124 (1930).

Descriptors: *New York, *Beaches, *Riparian rights, *Condemnation value, Shores, Coasts, Riparian land, Riparian waters, Condemnation, Eminent domain, Value, Property values, Land appraisal, Beds, Ownership of beds, Public rights, Real property, Seashores, Cities, Governments, Oceans, Legal aspects, High water mark, Tidal waters, Judicial decisions, Easements, Access routes, Navigable waters.

Plaintiff city, to establish a public beach, brought condemnation proceedings against defendant landowners seeking to acquire riparian and submerged lands and riparian rights. The court noted that those owners who had been granted submerged land and foreshore by the state were entitled to compensation for loss of their title. The trial court had erred in establishing an arbitrary and uniform award per lineal foot for loss of riparian rights along the ocean. The value of such rights should be determined by the diminished value of each parcel affected. The court also noted that owners who had been cut off from access to the water did not retain an easement of access since their riparian rights had been extinguished and they had been compensated therefor. (Liptak-Florida)
W71-03251

KENWELL V LEE (VALIDITY OF WATER DISTRICT CREATION AND BOND ISSUE).
142 Misc 413, 254 NYS 841-851 (1932).

Descriptors: *New York, *Water districts, *Water supply, *Assessments, Cities, Governments, Reservoirs, Lakes, Pipelines, Municipal water, Potable water, Water demand, Water rates, Taxes, Water works, Water sources, Legal aspects, judicial decisions, Administrative decisions, Adjudication procedure.

Plaintiff taxpayer brought action against defendant town supervisor to invalidate a bond issue and the establishment of a water district. Plaintiff contended that the plans for the proposed water system differed from those originally approved by the petition, that the use of a forest preserve lake for a water supply was unconstitutional, and that apportionment of the cost among all the taxpayers instead of those directly benefited was also unconstitutional. Dismissing plaintiff's claim, the court noted that certain changes in construction plans after the establishment of a water district are contemplated by those petitioning for the district, especially where the changes result in improved services at less cost. The court also noted that a natural lake with the proper intake pipes and modifications is a reservoir within the statutorily permitted use of preserve lands for water systems. Also, the system's benefits to the whole town justified a general tax to pay for the balance of the cost above the proceeds from the bond issue and from water rates. (Liptak-Florida)
W71-03252

PEOPLE V TOMPKINS-KIEL MARBLE CO (STATE TITLE TO SUBMERGED LAND UNDER RIGHT OF RE-ENTRY FOR CONDITION BROKEN).
148 Misc 559, 265 NYS 243-246 (1932).

Descriptors: *New York, *Land tenure, *Prescriptive rights, *Ownership of beds, Adjudication procedure, Real property, Beds, Beds under water, Judicial decisions, Legal aspects, State governments.

Plaintiff state brought action to defease defendant from all interest in a tract of submerged land. Plaintiff had granted to defendant's predecessor in interest a patent in submerged land, subject to a right of re-entry for condition broken, the condition being to fill the land and use it for commerce within five years. Plaintiff's grantee failed to satisfy th condition, and defendant received the tra through conveyances from him. Defendant move to dismiss plaintiff's action on the ground that was barred by the statute of limitations. Sinc plaintiff's grantee had never taken possessio plaintiff asserted that the action was not barre The court rejected plaintiff's assertion. Determi ing that plaintiff's right to sue for re-entry had a crued 40 years prior, and that defendant's co tinued possession was presumed so that proof adverse possession was unnecessary, the cou granted defendant's motion. (Hart-Florida)
W71-03253

PEOPLE V HAVEMEYER AND ELDER, IN (STATE TITLE TO FORMERLY SUBMERGE LAND UNDER RIGHT OF RE-ENTRY).
148 Misc 555, 265 NYS 249-253 (1933).

Descriptors: *New York, *Land tenure, *Owne ship of beds, *Docks, Real property, Beds, Be under water, Bulkhead line, Bulkheads, Piers, Jud cial decisions, Legal aspects.
Identifiers: *Commerce.

Plaintiff state brought action to defease defenda riparian landowner under a right of re-entry f condition broken. Plaintiff had conveyed su merged land to defendant on the condition that th land be filled and docks erected to promote com merce. Defendant had filled the property to th bulkhead line and erected piers and bulkhead operating a manufacturing plant and freight te minal on the premises. Plaintiff asserted that th use did not comply with the condition, since th freight terminal was not open to the public, an that defendant had leased the terminal, therefo failing to promote commerce. The court held th defendant's action clearly promoted commerc and therefore that plaintiff had no right of re-entr Defendant's motion to dismiss was granted. (Har Florida)
W71-03254

WESTCHESTER JOINT WATER WORKS NO V VILLAGE OF PELHAM (WATER WORK SEEKS TO ENJOIN CITY FROM SUPPLYIN ITS OWN WATER).

148 Misc 349, 265 NYS 491-494 (1933).

Descriptors: *New York, *Water works, *Citie *Water supply, Legislation, Hydrants, Water di tribution (Applied), Water rates, Water co veyance, Administrative agencies, Administrativ decisions, Legal aspects, Judicial decision Remedies.

Plaintiff water works sued to enjoin defendant ci from constructing its own water works syste without securing approval of the Water Power an Control Commission. Plaintiff was furnishing de fendant with water and had installed fire hydran in the city. Defendant planned to furnish its ow water and had petitioned the Commission for ap proval. However, the Commission refused jurisdic tion because of a statute empowering municipal ties to receive water from New York City witho approval. Plaintiff asserted that approval wa required. The supreme court held that no approv was required for defendant to operate its ow system. Since plaintiff did not possess an exclusiv franchise or have its rates fixed by a state bod plaintiff had no right to enjoin defendant's action (Hart-Florida)
W71-03255

GUCKER V TOWN OF HUNTINGTON (RIPARI AN OWNER'S TITLE TO SANDBAR B ACCRETION).
241 App Div 494, 272 NYS 45-49 (1934).

Descriptors: *New York, *Sand bars, *Dredging *Accretion (Legal aspects), Land tenure, Bounda ries (Property), Boundary disputes, Current

Water), Sand spits, Shoals, Shallow water, Bays, lets (Waterways), Real property, Riparian land, iparian rights, Navigable waters, Cities, Legal pects, Judicial decisions.

aintiff riparian landowners brought action to set ide quitclaim deeds to a sandbar as clouds upon le. Plaintiffs' land ran to the water's edge, and the sputed sandbar lay some 400 to 700 feet from aintiffs' boundary. It had been formed by accre- on over a period of years, but remained below ater level until it was dredged and filled to about 1 ot above water level. Plaintiffs asserted that be- re the dredging the sandbar was formed by accre- on from their upland and therefore that the boun- ry of their property had been extended by the cretion to include the sandbar. Determining that evidence showed that the accretion had formed m plaintiffs' uplands, and that 400 to 700 feet of ater lay between the uplands and the sandbar, the urt held that plaintiffs had not established title in e sandbar. Moreover, the quitclaim deeds were cloud upon their upland titles. Noting that the edging was a possible invasion of plaintiffs' arian rights, the court left plaintiffs free to seek rther remedy. (Hart-Florida)
71-03256

TSHIP DUCK CLUB V TOWN OF SEQUIM AVIGABILITY OF DUCK HUNTING AGOON).
5 F Supp 309-311 (WD Wash 1970).

escriptors: *Federal jurisdiction, *Navigable aters, *Non-navigable waters, *Lagoons, Inlets Waterways), Legislation, Recreation, Hunting, dal waters, Judicial decisions, Legal aspects, Ci- s, Adjudication procedure, Jurisdiction.

aintiff duck hunting club sued defendant wnship for damages caused by defendant's dike, d alternatively sought an injunction to prevent aintenance of the dike. Plaintiff owned property a peninsula, with a lagoon on one side and strait the other. Defendant's dike across the lagoon evented plaintiff from reaching its property by all boat. Defendant alleged lack of jurisdiction in federal courts because the lagoon was non- vigable, and therefore laws of the United States ere inapplicable. The court stated that: (1) a aterway is navigable if suitable for use as a ghway of commerce; (2) a water is suitable for ch use if presently suitable, suitable in the past, potentially suitable in the future with reasonable provements; (3) a waterway can be made suita- e only if the improvements are economically asible; and (4) the existence of tidewaters does t make waters navigable. Since the lagoon was itable for use only as an access to the duck hunt- g property, the court held that it was non-naviga- e. The action was dismissed for want of jurisdic- n. (Hart-Florida)
71-03257

ENNSYLVANIA ENVIRONMENTAL COUN- IL, INC V BARTLETT (HIGHWAY RELOCA- ION ENDANGERS STREAM ECOLOGY).
5 F Supp 238-253 (MD Pa 1970).

escriptors: *Ecology, *Highway relocation, Non-navigable waters, *Highways effects, Rivers d Harbors Act, Road construction, State govern- ents, Roadbanks, Road design, Sediment control, egislation, Federal government, United States, dministrative agencies, Balance of nature, En- ronmental effects, Judicial decisions, Legal pects.

aintiff environmental council sought an injunc- n to restrain defendant Pennsylvania secretary of ghways, in relocating a road, from encroaching on a stream. Defendant's planned relocation in- uded a landfill in a stream. Plaintiff contended ch landfill would harm the stream's ecology. mong other things, plaintiff asserted that the con- ruction would violate the Rivers and Harbors Act hich required that construction of a dike on a navigable river receive congressional approval. Assuming arguendo that the proposed construction would be a dike, stating that a river is navigable in law when navigable in fact, and relating a test that a stream is navigable if it is presently, was, or could be reasonably made suitable for use in commerce, the court held the Rivers and Harbors Act inapplicable. The evidence showed that the stream was non-navigable. Accordingly, the injunction sought by plaintiff was denied. (Hart-Florida)
W71-03258

UNITED STATES V 544 ACRES OF LAND (CHALLENGE OF TVA CONDEMNATION AS ULTRA VIRES).
314 F Supp 273-277 (ED Tenn 1969).

Descriptors: *Tennessee, *Real property, *Eminent domain, *Tennessee Valley Authority Project, Administrative agencies, Condemnation, Adjudication procedure, Administrative decisions, Federal government, United States, Federal project policy, Political aspects, Legal aspects, Judicial decisions.

Plaintiff United States sought summary judgment in eminent domain proceedings against defendant land. The owners of the land asserted that relator Tennessee Valley Authority's condemnation was ultra vires. The court noted that the necessity of condemnation for public use was a purely political question for the legislative branch and that neither the amount, character, or specificity of the particular acreage to be acquired was a subject for judicial inquiry. Congress had delegated condemnation authority to relator who, in seeking congressional appropriation for the project, had fully advised Congress of the nature, scope, and purpose of the condemnation. Defendant could not complain of the delegation of authority to relator. Holding that relator was fully empowered to condemn the land, and that no material issue of fact existed, the court gave summary judgment for plaintiff. (Hart-Florida)
W71-03259

UNITED STATES V FLORIDA POWER AND LIGHT CO (THERMAL POLLUTION OF BISCAYNE BAY).
311 F Supp 1391-1392 (SD Fla 1970).

Descriptors: *Florida, *Water pollution, *Pollution abatement, *Thermal pollution, Water pollution sources, Cooling water, Industrial wastes, Ecology, Aquatic microbiology, Balance of nature, Judicial decisions, Legal aspects, Bays, Inlets (Waterways), Remedies, Powerplants.
Identifiers: *Injunction (Prohibitory).

Plaintiff United States sought an injunction to restrain defendant power company from discharging heated water into Biscayne Bay. Having determined that the plant's operation was not causing irreparable harm to the bay's ecology, the court refused to grant the preliminary injunction sought. The court noted that the existing thermal pollution was causing minimal retrievable damage, but defendant was planning to reduce this to a benign level by 1971. (Hart-Florida)
W71-03260

FLOOD AND EROSION CONTROL (PROJECT AUTHORITY AND ADMINISTRATION).

Iowa Code Ann secs 467B. 1-467B. 15 (Supp 1969).

Descriptors: *Iowa, *Administrative agencies, *Flood control, *Erosion control, Legislation, Costs, Construction, Levees, Easements, Federal government, Cost sharing, Watershed management, Project planning, Maintenance, Soil conservation, Water management (Applied), Administration, Water utilization, Land, Flood protection, Financing, Cost allocation, Taxes, Coordination, Local governments.

Outlined in this Iowa legislation are the operation of flood and erosion control projects in Iowa and water conservation, development, utilization, and disposal projects by state and local agencies in cooperation with the federal government. Counties where projects are to be carried on are given jurisdiction and authority through the board of supervisors to construct, operate and maintain projects on county lands. Such projects are presumed to be for the protection of public roads and lands and for public health and general welfare. In implementing projects counties may accept federal aid in accordance with chapter provisions and may cooperate with any federal, state or local agency. Cooperation between agencies is authorized. Chapter provisions outline allocation of various project costs, maintenance costs, taxes, and payments from the Federal Government. Other provisions describe the duties of soil conservation commissioners regarding flood and erosion control projects and the applicable law and procedure in maintenance of projects. (Duss-Florida)
W71-03261

ESTABLISHMENT AND OPERATION OF METROPOLITAN SEWERAGE COMMISSIONS.
8 Wis Stat Ann sec 59.96 (1957) as amended (Supp 1970).

Descriptors: *Wisconsin, *Administrative agencies, *Cities, *Sewage districts, Sewage disposal, Sewage treatment, Sewers, Pumping plants, Watercourses (Legal), Drains, Water supply, Potable water, Construction, Legislation, Surface water, Easements, Permits, Conduits, Condemnation, Diversion, Water pollution, Local governments, administration, Sewage, Legal aspects.

In counties with more than 500,000 population, which have passed resolutions declaring the need for sewage disposal works, and which have qualified and appointed sewerage commissions, this Wisconsin legislation provides for appointment of sewerage commissioners. Metropolitan sewerage commissions may by resolution add to their district other areas within their county where such areas drain or may drain sewage into water which is or may be used as a source of drinking water. Procedures are outlined for adding such areas. The sewerage commissions have the power and duty to plan and construct sewers, pumping and temporary disposal works for the collection and transmission of various types of sewage. Commissions may improve watercourses and divert water as long as they comply with procedures outlined in the statute. Commissions may promulgate rules and regulations for the operation of their systems and may acquire land needed to implement systems. Except as allowed by the statute, the commissions' power shall not extend to first class cities implementing their own sewerage system. Financing of improvements and tax levying procedures are also outlined. (Duss-Florida)
W71-03262

LIABILITY OF COUNTY COMMISSIONERS IN SUITS INVOLVING PUBLIC HIGHWAYS AND BRIDGES.
Ohio Rev Code Ann sec 305.12 (1953).

Descriptors: *Ohio, *Highways, *Local governments, *Remedies, Legal aspects, Adjudication procedure, Legislation, Roads, Bridges, Levees, Governments, Administration, Grading, Embankments, Paving, Roadbanks, Road construction, Maintenance, Ditches, Drains, Damages, Bridge failure, Bridge construction, Watercourses (Legal), Repairing.

The board of county commissioners may bring or defend any suit involving injury to any public, state, or county road, bridge, ditch, drain, or watercourse established by such board in its county. The board is liable in its official capacity for any damage resulting from its negligence in repairing such public facilities. (Dye-Florida)
W71-03263

DRAINAGE DISTRICTS (ANNEXATION, REPAIR, CONSTRUCTION, IMPROVEMENT: COUNTY COURT JURISDICTION).
13 Mo Ann Stat secs 243.140-243.230 (1952).

Descriptors: *Missouri, *Surface drainage, *Drainage districts, *Administration, Administrative agencies, Legislation, Ditches, Drains, Bridges, Culverts, Maintenance, Benefits, Damages, Outlets, Contracts, Projects, Land tenure, Planning, Channels, Construction, Taxes, Swamps, Jurisdiction, Legal aspects, Repairing.

Stating that county courts shall have jurisdiction over such matters, this Missouri legislation outlines circumstances and procedures under which lands outside of drainage districts may be annexed to them. Also, the county court in a drainage district has the power to authorize the construction, repair or improvement of works for the district. The court's discretionary power in this area is outlined, and procedures are established. County-owned swamp lands which benefit from drainage-district works shall be assessed as to benefits and damages as any other land. After confirmation of the viewers' and engineers' reports assessing benefits and damages, the court shall appoint a competent drainage district engineer. His duties and powers are outlined. The county court shall approve or reject all contracts and bonds of the district. Defaulting contractors are liable for all damages, costs and expenses occasioned by their default. Procedures are outlined for construction or enlargement of any bridge or culvert in conjunction with the construction of drainage ditches. Chapter provisions also apply to channels and sloughs where the district has constructed outlets. (Duss-Florida)
W71-03264

TUCKER V HAGAN (LIABILITY FOR DISCHARGE OF SURFACE RUNOFF UNTO SERVIENT ESTATE).
300 SW 301-305 (Mo 1927).

Descriptors: *Missouri, *Diversion, *Riddance (Legal aspects), *Surface runoff, Alteration of flow, Natural flow doctrine, Railroads, Culverts, Judicial decisions, Legal aspects, Ditches, Conveyance structures, Rivers, Watercourses (Legal), Relative rights, Floods, Adjudication procedure.

Defendant managed property adjacent to plaintiff's farmland. Both tracts were bounded on the north by a river and on the south by a railroad track. During rainy seasons, water flowed through a railroad culvert, then along a depression on defendant's land and emptied into the river. This culvert became obstructed, forcing water to flow along the side of the railroad track until it emptied into the river across the corner of plaintiff's property. Defendant cleared the culvert and constructed a ditch from the culvert, along the railroad track, near the line between both parties' property. The water, not under control after it passed through the ditch, inundated plaintiff's lower land. Plaintiff's successful action for damages to his crops was affirmed by the St. Louis Court of Appeals. The court stated that although landowners have the right to divert surface water from their premises, a dominant proprietor may not collect surface water and discharge it by artificial means, in increased volume, onto a servient estate. Plaintiff was not required to show negligent construction of the ditch, only wrongful discharge of water. (Powell-Florida)
W71-03265

BRUSH V LEHIGH VALLEY COAL CO (LIABILITY FOR COAL WASTE DEPOSITION).
290 Pa 322, 138 A 860-863 (1927).

Descriptors: *Pennsylvania, *Coal mine wastes, *Navigation, *Rivers and Harbors Act, Pollutants, Water pollution, Water pollution effects, Water pollution sources, Damages, Flooding, Wastes disposal, Navigable waters, Legislation, Federal Government, Obstruction to flow, Riparian land, Riparian waters, Riparian rights, Easements, Stream overflow, Judicial decisions, Legal aspects.

Plaintiff landowner sought to recover damages for injury to his land caused by the flooding of an adjacent river. The river had been polluted by coal wastes from defendant's upstream colliery. Defendant interposed as a defense a release from liability which had been granted by plaintiff's predecessor in title. Plaintiff contended that such a release was void as: (1) in violation of congressional act; (2) as authorizing the creation of a public nuisance; and (3) as against public policy. The court held that the release did not violate the congressional act preventing deposits which obstruct navigable waters since no interference with navigation was shown to result from defendant's coal waste deposits. Moreover, no proof as to the river's navigability at the point of waste deposit was shown, thus negating the applicability of the act which required a showing of navigability. The court also found that plaintiff, based upon a period of prescription, had granted defendant an easement to do the acts complained of. A contention that the release was void because it purported to exempt defendant from liability for negligence was discarded because there was no showing of negligence at trial. The lower court's decision was affirmed. (Barnett-Florida)
W71-03266

S S KRESGE CO V RAILROAD COMM'N (NO RIPARIAN RIGHT TO ERECT STRUCTURES IN NAVIGABLE RIVER WITHOUT STATE CONSENT).
236 NW 667 (Wis 1931).

Descriptors: *Wisconsin, *Navigable waters, *Structures, *Permits, Riparian rights, Rivers, Streams, Navigable rivers, Riparian land, Riparian waters, Beds, Riverbeds, Regulation, Navigation, Buildings, State governments, Legislation, Legal aspects, Judicial decisions.

On motion for rehearing in an action involving plaintiff corporation's right to replace a building on a navigable river, the court noted in a per curiam opinion that a riparian owner has no right, without state consent, to erect any structure in the bed of a navigable river. It does not matter that the structure is in aid of navigation. The court also noted that the state could not approve such a structure if it would preclude the state from later requiring the structure's removal when necessary to aid navigation. (Liptak-Florida)
W71-03267

MCWHORTER V CITY OF CLARKSBURG (PRESCRIPTIVE RIGHT TO OVERFLOW LAND AS A DEFENSE).
161 SE 577-580 (W Va 1931).

Descriptors: *West Virginia, *Dams, *Flooding, *Prescriptive rights, Flow, Land, Real property, Streams, Water storage, Legal aspects, Judicial decisions, Adjudication procedure, Cities, Local governments, Mill dams, Mills, Structures, Riparian rights, Obstruction to flow, Condemnation, Damages, Remedies.

Defendant city constructed a dam on the site of an old gristmill, flowing plaintiff's lands. Plaintiff sought damages for the value of the land flowed, contending that the property flowed had been condemned and that plaintiffs were entitled to compensation. Defendant contended that the operation of the gristmill without condemnation of flowage rights had created a prescriptive right in defendant to flow the same land for general purposes. The trial court instructed the jury to award damages to plaintiff if his land was flowed, ignoring defendant's defense of prescriptive right. The jury found for plaintiff. The Supreme Court of Appeals of West Virginia reversed the trial court, and a new trial was ordered. A binding jury instruction which ignores a legal defense supported by substantial evidence is erroneous. The maintenance of the original dam for mill purposes entitled the mill owners and their successors to continue its use, to the extent that the servitude was not increased, for general purposes. (Dye-Florida)
W71-03268

KITCHEN LUMBER CO V TALLASSEE POWER CO (WASHOUT OF RAILROAD BRIDGE CAUSED BY NEGLIGENT OPENING OF DAM FLOODGATES).
For primary bibliographic entry see Field 04A.
W71-03269

NECHES CANAL CO V MILLER AND VIDOR LUMBER CO (LOSS OF PROFITS FROM UNLAWFUL DAM ERECTION).
24 F2d 763-765 (5th Cir 1928).

Descriptors: *Dams, *Lumbering, *Water pollution, *Permits, Legislation, Water supply, Administrative agencies, Water pollution sources, Pollutants, Water pollution effects, Rivers, Saline water, Sea water, Saw mills, Luber, Profit, Depreciation, Damages, Judicial decisions, Legal aspects, Obstruction to flow.

Plaintiff lumber company sought to restrain defendant from maintaining a dam obstructing the free and open navigation of the Neches River. Plaintiff used the river to transport logs and contended that defendant had not obtained for the dam the express authority required by statute. Plaintiff also sought to recover damages caused by the erection of the dam. Defendant city had erected the dam to prevent the pollution of its water supply from salt water, dead fish and other debris which traveled up the river from the Gulf of Mexico during times of temporary drought conditions. Plaintiffs contended that as a result of damming the river their logs became watersoaked and sank, that they were unable to maintain their normal level of business, and that the mill had to be closed. The appellate court affirmed the lower court decision for plaintiffs stating that the obstruction was unlawful. Defendant had not obtained governmental approval prior to construction. However, the amount of damages as determined in the court below was modified. (Hart-Florida)
W71-03270

NEWTOWN CREEK TOWING CO V ASTORIA IMPORTING AND MFG CO (DAMAGE TO TUG BY LUMBER).
47 F2d 578-579 (2d Cir 1931).

Descriptors: *Admiralty, *Ships, *Lumber, *Navigable rivers, Boats, Propellers, Lumbering, Navigation, Judicial decisions, Legal aspects, Adjudication procedure, Piers.

Libelant towing company brought libel against respondent importing company for damages allegedly caused by libelant's striking one of respondent's logs in a navigable river. Respondent imported mahogany logs for veneer. These logs were towed upriver and secured to respondent's wharf by individual lines and a log boom enclosure. Libelant's tug came upriver at night, passing and seeing respondent's logs secured to the wharf, picked up a coal barge and proceeded back downriver. As the tug and barge passed respondent's wharf, the tug hit an obstruction. Libelant asserted that it had struck one of respondent's logs. The court noted that respondent had a duty to secure its logs with reasonable care, but concluded that libelant had not proven that the obstruction was one of respondent's logs. The libel was dismissed. (Powell-Florida)
W71-03271

BARR V SPALDING (UNITED STATES' LIABILITY FOR RAISING RIVER ABOVE HIGH WATER MARK).
46 F2d 798-802 (WD Ky 1927).

Descriptors: *High water mark, *Ownership of beds, *Flooding, *United States, Kentucky, Navigable rivers, Land tenure, Adjudication procedure, Ohio River, Low water mark, Boundaries (Property), Navigation, Dams, River beds, Riparian rights, Judicial decisions, Legal aspects, Eminent domain, Beds under water, Riparian land, Easements.
Identifiers: *Constitutionality.

Plaintiff riparian landowner sought to restrain defendant district engineer from building a dam on the Ohio River. On defendant's motion to dismiss, the court stated that: (1) whether a riparian owner holds title in a navigable streambed is a question of local law; (2) in Kentucky, a riparian owner is presumed to hold title to the thread of a stream, but this presumption may be overcome by contrary language in the deed; (3) title in land to the low water mark is subject to Congress' paramount right to improve navigation; (4) the United States' power to improve navigation is limited only by the fifth amendment; (5) the United States may raise the level of a stream to the high water mark without a fifth amendment 'taking'; and (6) threatened damages to riparian land do not constitute a 'taking'. The court concluded that plaintiff's deed conveyed title only to the low water mark. Accepting plaintiff's contention that land above the high water mark was threatened, the court denied defendant's motion. On final submission, defendant conceded liability for an injury above high water mark, and the court accordingly dismissed the action. (Hart-Florida)
W71-03272

PADUCAH-ILLINOIS RR V GRAHAM (RAILROAD PROPERTY SUBJECT TO AD VALOREM TAXATION).

46 F2d 806-811 (WD Ky 1931).

Descriptors: *Ohio River, *Kentucky, *Taxes, *Boundaries (Property), Boundary disputes, Navigable rivers, Railroads, Ownership of beds, River beds, Judicial decisions, Legal aspects.

In an action concerning the amount of plaintiff railroad's property subject to ad valorem taxation by defendant sheriff representing the Kentucky school district, the court stated that the portion of the Ohio River bed lying between thread of the river and low water mark on the northern bank was unappropriated state land, despite its inclusion within the Kentucky boundary. (Hart-Florida)
W71-03273

THE COLOMBO (DISCHARGE OF OIL INTO NAVIGABLE WATERS).
42 F2d 211-212 (2d Cir 1930).

Descriptors: *Rivers and Harbors Act, *Ships, *Water pollution, *Oil, Legislation, United States, Water pollution sources, Water pollution control, Pollutants, Pollution abatement, Federal government, Judicial decisions, Legal aspects, Admiralty.

United States brought libel against the vessel Colombo for discharge of oil into navigable waters of the United States. A federal statute provided strict liability for discharging various substances but did not expressly include oil. However, the court held that the language of the statute was sufficiently broad to include oil. Since the discharge was inadvertent, the court applied the minimum penalty. (Hart-Florida)
W71-03274

FLAMBEAU RIVER LUMBER CO V LAKE SUPERIOR DIST POWER CO (OBSTRUCTION OF NAVIGABLE STREAM BY IMPROPER DAM OPERATION).
227 NW 276-278 (Wis 1929).

Descriptors: *Wisconsin, *Dams, *Lumbering, *Hydroelectric plants, Lumber, Adjudication procedure, Judicial decisions, Legal aspects, Banks, Overflow, Gates, Floodgates.

Plaintiff lumber company sued defendant power company for damages from unlawful obstruction of a navigable stream. Plaintiff's complaint alleged that defendant, by erecting its dam, had raised the water level over stumps and various standing and fallen timber which should have been removed before building the dam. This and defendant's unreasonable opening and closing the gates of the dam had caused plaintiff's lumber to be trapped in these stumps and timber. Defendant asserted that the complaint failed to state a cause of action because it alleged conclusions of law rather than facts. Stating that defendant could not bey demurrer compel plaintiff to set up and anticipate its defenses in the complaint, the court held that the complaint stated a cause of action. (Hart-Florida)
W71-03275

BENEDICT V LUNN (CLAIM FOR REFUND BASED UPON INVALID GRANT OF TITLE TO LAND).
244 NY 373, 155 NE 677-679 (1927).

Descriptors: *New York, *Ownership of beds, *Land tenure, *State governments, Legal aspects, Judicial decisions, Remedies, Local governments, Administrative agencies, Contracts, Legislation, Riparian land, Streambeds, Landfills, Shores, Boundary disputes, Boundaries (Property), Beds under water.

Plaintiff's predecessor-in-title had purchased from the state certain lands under a creek adjacent to his upland. Title to the land in question had been litigated previously and was found to lie in the City of New York. As a result, the state's attempted grant to plaintiff's predecessor was void. Plaintiff sought the return of the purchase money. Defendant state land commissioners contended that the decision of the previous case was not binding and also that plaintiff's predecessor-in-title had purchased not a fee title, but only a franchise to fill in the submerged land within a five-year period. Having failed to fill the land, the franchise had expired. The Court of Appeals of New York, in reversing a lower court decision for defendant, held that the previous case was binding authority as to title. The state had attempted to grant fee title, subject to divestment if the land was not filled within five years. However, since the state had no title to grant, plaintiff could not lose such title for failure to satisfy the condition. Plaintiff did not have title under his grant from the state, and he was entitled to reclaim his purchase money. (Morris-Florida)
W71-03276

MORTON V CHESAPEAKE AND O RY (ALTERATION OF STREAM'S COURSE AS PERMANENT OR TEMPORARY INJURY).
240 Ky 199, 41 SW2d 1110-1111 (1931).

Descriptors: *Kentucky, *Adjudication procedure, *Damages, *Alteration of flow, Streams, Water injury, Landfills, Rocks, Erosion, Pile foundations, Legal aspects, Judicial decisions, Obstruction to flow, Railroads.

Plaintiff landowner sued defendant railroad company for damages to land. A small creek ran on defendant's right-of-way. Defendant's railroad track was placed on a fill 25 feet high, and defendant placed rocks in the creek to prevent it from eroding the fill. Plaintiff contended that the rocks caused the stream to cut an alternate course through his land. Plaintiff appealed from a lower court judgment awarding him only $300 of $2000 requested, asserting error for failure to instruct the jury on the measure of damages for a temporary structure. Plaintiff contended that where the injury was caused by failure to use due care to protect adjacent property, or where the structure could be removed at reasonable expense, damages may be recovered for each invasion. Defendant contended that the structure was permanent and necessary and could not be removed without an unreasonable and disproportionate cost. The court held that since the jury instructions had not been included in the record by court order, the exceptions to the instructions could not be considered. The lower court's decision was affirmed. (Hart-Florida)
W71-03277

STATE V BROAD RIVER POWER CO (STATE'S POWER TO GRANT CANAL LAND).
181 SE 41-56 (SC 1935).

Descriptors: *South Carolina, *Electric power, *Canals, *Claims (Contracts), State governments, Legal aspects, Judicial decisions, Adjudication procedure, Governments, Land, Real property, Navigable waters, Navigation, Contracts, Contract administration, Negotiations, Performance, Land tenure, Electric power industry, Legislation, Public utilities, Industries, Utilities.
Identifiers: *Constitutionality.

Defendant power company acquired property from plaintiff state along with the right to construct canals and power generating facilities on a river. In return defendant agreed to extend a canal and provide certain services to plaintiff. Defendant failed to perform some of the acts required by the contract, but plaintiff, in an earlier action, was denied title to the property by forfeiture. Plaintiff and defendant then entered into a new contract whereunder defendant was obligated for money payments in lieu of the services required by the original contract. Plaintiff's attorney general sought in the instant action to have the later agreement declared unconsitutional under a provision prohibiting donations of public land by the state. The Supreme Court of South Carolina affirmed a lower court judgment for defendant. The constitutional provision referred only to land, not to other contractual property rights. In addition, defendant's new monetary obligation rebutted the existence of a donation by plaintiff. Also, a navigation trust imposed on navigable waters did not extend to land granted for the construction of a canal. (Dye-Florida)
W71-03278

COLONNA V STATE (RIGHT OF LESSOR TO RECOVER LOST PROFITS WHEN STATE'S NEGLIGENCE PREVENTS MINING).

224 App Div 173, 230 NYS 19-24 (Sup Ct 1928).

Descriptors: *New York, *Leases, *Quarries, *Canal seepage, Compensation, Mining, Gravels, Rock excavation, Canals, State governments, Mine drainage, Mine water, Exploitation, Contracts, Real property, Leakage, Water loss, Legal aspects, Judicial decisions, Remedies, Damages.
Identifiers: *Negligence.

Plaintiff lessor brought action to recover lost profits caused by defendant state's negligence. Plaintiff had leased a quarry on his land to a third party, agreeing to receive in consideration 8% of the market value of the stone produced. The lessee was unable to pump the water from the quarry to begin operations because a nearby canal constructed by defendant state leaked into the quarry. The lessee sued defendant and recovered his lost profits, less the royalties due plaintiff, and plaintiff then sued to recover his 8%. Defendant contended that plaintiff's profits were contingent upon sale of the stone, and that since no stone was quarried, plaintiff could not recover. Plaintiff asserted that the agreement was not for the sale of the stone, but for a lease of the property. Determining that a mining lease was a lease of land, rather than a sale of the excavated material, the court held that plaintiff could recover. (Hart-Florida)
W71-03279

HYDRAULIC RACE CO V GREENE (USE OF SURPLUS WATER FROM NEW YORK BARGE CANAL).

133 Misc 410, 233 NYS 49-63 (Sup Ct 1928).

Descriptors: *New York, *New York State Barge Canal, *Leases, *Surplus water, Legislation, State governments, Administrative agencies, Canals, Legal aspects, Judicial decisions, Relative rights.

Plaintiff lessee brought action to enjoin defendant interloper from interfering with plaintiff's use of surplus water from the New York State Barge Canal. Plaintiff's predecessors had acquired a perpetual lease on the surplus water from the original Erie Canal. As subsequent enlargement of the canal greatly increased the amount of surplus water, plaintiff used this additional water as well as the water authorized by the lease. Defendant claimed the right to use this excess water. Plaintiff contended that the original lease authorized him to use any water, exceeding the amount of the original lease, created by enlargement of the canal. Interpreting the statute authorizing lease of the surplus water, and plaintiff's lease, the court determined that the statute permitted the canal commissioners to lease only that water which was surplus at that time; the lease conveyed only that amount. Furthermore, the court held that the state's acquiescence in plaintiff's use of the additional water, and construction of raceways for surplus water, did not alter the character of the lease. Accordingly, plaintiff's complaint was dismissed. (Hart-Florida)
W71-03280

MILLER V MCLAUGHLIN (ABILITY OF STATE TO REGULATE FISHING IN RIVER OVER WHICH SISTER STATE HAS CONCURRENT JURISDICTION).
281 US 261, 50 S Ct 296-297 (1930).

Descriptors: *Nebraska, *Iowa, *Fishing gear, *Interstate rivers, Fish conservation, Nets, Fish, Sport fishing, Legal aspects, Judicial decisions, Legislation, Jurisdiction, Fishing, Federal government, State governments, Regulation.
Identifiers: *Constitutionality.

Plaintiff Nebraska resident sought to enjoin enforcement by defendant state of Nebraska of a statute prohibiting the possession or use of fishing nets, traps, or seins. The middle of the Missouri River formed the border of Iowa and Nebraska, and an act of Congress gave Iowa and Nebraska concurrent jurisdiction over the River. Iowa statutorily authorized the use of nets within its waters. Plaintiff contended that: (1) Nebraska could not enforce its anti-seining statute without the concurrence of Iowa and, (2) prohibiting the mere possession of fishing instruments constituted a denial of due process. The Supreme Court of the United States held that concurrent jurisdiction by a sister state does not deprive a state of the right to regulate fishing on areas of the river within its own territory. Upholding the validity of Nebraska's statute, the court ruled also that prohibiting the mere possession of fishing implements within a state does not deny due process. Plaintiff was refused injunctive relief. (Earl-Florida)
W71-03281

VERMONT V NEW HAMPSHIRE (STATE BOUNDARY LINES AS DETERMINED BY LOW WATER MARK OF RIVER).

290 US 579, 54 S Ct 265-267 (1934).

Descriptors: *Low water mark, *Boundary disputes, *New Hampshire, *Vermont, Boundaries (Property), Judicial decisions, Legal aspects, Interstate, Water level fluctuations, Rivers, Droughts, Interstate rivers, State governments, Land tenure.

In an action to determine the boundary line between plaintiff state of Vermont and defendant state of New Hampshire, the Supreme Court of the United States decreed the boundary line to be the low water mark of a common, bordering river. The Court held that the low water mark was the point to which the river recedes at its lowest stage, without reference to, and unaffected by, extreme droughts, but subject to later changes effected by erosion or accretion. (Earl-Florida)
W71-03282

SINCLAIR REFINING CO V SMITH (LIABILITY FOR DECREASE IN CHANNEL DEPTH CAUSED BY NEGLIGENT DREDGING).
13 F2d 68-71 (5th Cir 1926).

Descriptors: *Dredging, *Shoals, *Channel improvement, *Navigable waters, Levees, Legal aspects, Judicial decisions, Channel flow, Navigation, Ships, Damages.

Defendants sought relief from a decree requiring them to dredge a channel to the depth existing before their earlier dredging operations, which had shoaled a previously navigable channel. Plaintiff riparian owner obtained the decree after materials which defendants had dredged from the channel escaped from a levee and prevented vessels from reaching plaintiff's shipyard. Defendants contended that concurrent dredging operations by the government required the plaintiff to establish what portion of shoaling resulted from the defendants' dredging. The court held that where shoaling is proximately and initially caused by dredging operations, it is no defense that concurrent dredging operations add to a decrease in channel depth. Noting the defendants were not responsible for future maintenance of the channel, the court ruled it proper to require the defendants to pay damages until the channel's navigability was restored. (Earl-Florida)
W71-03283

INDIAN REFINING CO V AMBRAW RIVER DRAINAGE DIST (INJUNCTION AGAINST MUNICIPALITY'S INTERFERENCE WITH RIPARIAN'S RIGHT TO UNDIMINISHED FLOW).
1 F Supp 937-942 (ED Ill 1932).

Descriptors: *Drainage districts, *Alteration of flow, *Illinois, *Riparian rights, Riparian water loss, Drainage effects, Relative rights, Riparian land, Local government, Prescriptive rights, Natural use, Right-of-way, Eminent domain, Drainage programs, Judicial decisions, Legal aspects, Water levels, Pumping, Remedies, Waste water disposal.
Identifiers: *Constitutionality, Injunction (Prohibitory).

Plaintiff riparian owner sought to enjoin defendant, a statutorily authorized municipal drainage district, from altering the course and level of a river. For a period exceeding twenty years plaintiff had withdrawn water for its refinery and had discharged waste water through downstream drains. Plaintiff contended that defendant's actions would lessen the efficiency of its pumps and create a reverse flow into its drains. Defendant asserted that plaintiff would have only consequential damages and thus no injunctive remedy. The federal district court held that a riparian owner vested with both natural and prescriptive rights may enjoin substantial alteration of water level by a municipal drainage district. Such action by a drainage district is not within the police powers of the state. The court decreed that: (1) ownership of land abutting a river is riparian and extends to the center thread of the stream; (2) easement and right-of-way ownership create riparian rights; (3) riparian rights may be acquired by prescription, and (4) riparian ownership includes the right of using water for proper incidental purposes and having stream flow uninterrupted by material diminution or alteration. Defendant's actions were enjoined on grounds that they would produce substantial damage to, and an unconstitutional taking of, plaintiff's riparian rights. (Earl-Florida)
W71-03284

NE-BO-SHONE ASS'N V HOGARTH (RIGHT OF GENERAL PUBLIC TO FISH IN NAVIGABLE RIVER).

7 F Supp 885-891 (WD Mich 1934).

Descriptors: *Public rights, *Ownership of beds, *Sport fishing, *Navigable rivers, Riverbeds, Beds, Beds under water, Rivers, Streams, Recreation demand, Obstruction to flow, Michigan, Access routes, Legal aspects, Judicial decisions, Land tenure, Navigation.

Plaintiff riparian owner sought to enjoin defendant state of Michigan's removal of obstacles which had been placed in a river to create a private fishing preserve. The river, not navigable by commercial vessels, was primarily a trout stream, but had been used for log flotation. Plaintiff averred his riparian ownership gave him the right to add to existing obstacles to prevent the passage of sport fishermen and boats. Defendant contended that the river's navigability created a public right to fish thereon. Finding the river navigable, the court held that under Michigan law a public trust exists on all navigable riverbeds. Therefore, a riparian owner has only co-equal fishing rights with the public and may not bar the public's waterborne access to such fishing. Recognizing the increasing need for recreational use of rivers, the court refused to enjoin the state's removal of obstacles in the river. The court defined a navigable river as one which in its natural state is capable of floating logs, boats, and rafts. (Earl-Florida)
W71-03285

NORFOLK AND W RY V MCCOY (RAILROAD'S FILL DIVERTS RIVER, ERODING FARMLAND).
250 Ky 190, 61 SW2d 1080-1082 (1933).

Descriptors: *Kentucky, *Diversion, *Damages, *Accelerated erosion, Erosion, Railroads, Alteration of flow, Flow around objects, Bank erosion, Adjudication procedure, Navigable rivers, Administrative agencies, Permits, River flow, Judicial decisions, Legal aspects, Remedies.

Plaintiff riparian farmowner sued defendant railroad for damages caused by diversion of a river. Plaintiff's farm was situated on the inside of a horseshoe bend in the river. Defendant filled in the river to construct a second track, and plaintiff contended that this fill diverted the river, causing erosion to his land. Defendant contended that since the fill was authorized by a War Department permit, plaintiff could not recover. However the court, in rejecting defendant's contention, observed that the permit expressly did not authorize injury to private property. Defendant also asserted that the damages awarded were excessive. In this context, the appellate court found that the farm had eroded only a few feet in six years. The court held that the $2000 jury verdict was excessive and reversed the lower court's decision. (Hart-Florida)
W71-03286

LAMB KNITTING MACH CO V CHICOPEE MFG CO (LITIGATION OVER AGREEMENT TO FURNISH WATER POWER).
273 Mass 506, 174 NE 130-135 (1930).

Descriptors: *Massachusetts, *Dams, *Water rights, *Contracts, Water conveyance, Water supply, Turnouts, Cofferdams, Dam construction, Diversion structures, Penstocks, Judicial decisions, Legal aspects, Canals, Competing uses, Relative rights, Power system operations.

Plaintiff machinery company sought to enjoin defendant manufacturing company from hindering its extraction of water from a canal for power purposes. In conveying land to defendant's predecessor, plaintiff's predecessor had reserved the right to water flowing through a 1 x 2 ft. hole at the surface of a canal, and the agreement was later modified to permit substitution of a 3 ft. penstock and raceway as the aperture. The penstock and raceway were later closed under the provisions of a further subsequent agreement. In the court below the master found that after the final agreement plaintiff had only the right to water passing through the original aperture. On appeal, plaintiff contended that the agreement had enlarged, not diminished, his rights. The appellate court held that the wording of the

agreement supported the master's contrary finding. Defendant was no longer required to maintain the discharge raceway for plaintiff. However, the court modified the decree to permit plaintiff to use a forced draft, and limited defendant's right to draw down the canal to reasonable times and means. (Hart-Florida)
W71-03287

VILLAGE OF ASHAROKEN V METROPOLITAN SAND AND GRAVEL CO (UPLAND OWNER HAS NO VESTED RIGHT TO FUTURE ACCRETIONS).
141 Misc 829, 253 NYS 294-298 (1931).

Descriptors: *Jetties, *New York, *Riparian rights, *Accretion (Legal aspects), Channel improvement, Navigable waters, Bays, Riparian land, Riparian waters, Natural flow doctrine, Obstruction to flow, Erosion, Bank erosion, Alteration of flow, Sands, Excavation, Channels, Cities, Shore protection, Coastal structures, Real property, Remedies, Legal aspects, Judicial decisions, Land tenure.

Plaintiff town brought action to restrain defendant sand and gravel company from erecting jetties and dredging a channel. Plaintiff contended that the jetties and channel in front of defendant's upland would interfere with the natural water flow, thereby preventing future accretion to plaintiff's adjacent upland and increasing the erosion of plaintiff's land. The court noted that the question of whether a riparian owner has a vested right to future accretion was one of first impression in any jurisdiction. Finding that the evidence disputed any increase in erosion resulting from the jetties or channel, the court held that future accretions are too speculative to create a vested right in the upland owner. Judgment was entered for defendant. (Liptak-Florida)
W71-03288

WALKER V UNITED STATES (VALIDITY OF TAX DEEDS TO OCEANFRONT PROPERTY).
428 F2d 1229-1233 (Ct Cl 1970).

Descriptors: *Taxes, *Beaches, *Land tenure, *Boundaries (Property), United States, Federal government, State governments, Florida, Assessments, Eminent domain, Condemnation, Legal aspects, Seashores, Riparian land, Shores, Coasts, Oceans, Judicial decisions, Adjudication procedure, Legislation.

Plaintiff brought action against the United States seeking compensation for beachfront property purchased for use in the space program. The United States had purchased the property from persons holding state tax deeds for plaintiff's nonpayment of taxes. Plaintiff contended that the tax deeds were invalid because the property had been used as a public beach and was, therefore, not assessible for taxes. Dismissing plaintiff's complaint, the court noted that the tax deeds specifically excluded the actual beach and that, if plaintiff's contention were true and the land were public beach, the state and not plaintiff would be the proper party to bring the action. (Liptak-Florida)
W71-03289

TEXAS EASTERN TRANS CORP V CITY OF INDIANAPOLIS (REGULATION OF PIPELINE TRAVERSING PUBLIC RESERVOIR).
262 NE2d 512-515 (Ind 1970).

Descriptors: *Indiana, *Pipelines, *Reservoirs, *Permits, Regulation, Flood damage, Local governments, Cities, Easements, Condemnation, Eminent domain, Flood control, Flood protection, Watershed protection, Public rights, Administrative decisions, Administrative agencies, Legal aspects, Judicial decisions.

Plaintiff oil company sought to recover damages from defendant city for interference with a pipeline easement. Plaintiff contended that the cost of laying and maintaining the pipeline had been greatly increased when defendant erected and filled a reservoir, thereby flooding portions of the pipeline. Defendant contended that plaintiff had failed to comply with the flood control commission's requirements for weighting the pipeline and for taking extra precautions against leakage. Affirming the flood control commission's denial of damages, the Supreme Court of Indiana noted that plaintiff's failure to take the required precautions was the cause of its extra expense. The court also noted that the flood control commission had the power, as a condition of plaintiff's pipeline permit, to require plaintiff to take such precautions at its own expense. Such pipeline easements are always subject to the public right to make needed improvements. (Liptak-Florida)
W71-03290

PEOPLE V GIBSON AND CUSHMAN OF NEW YORK (VALIDITY OF LOCAL DREDGING REGULATION IN NON-NAVIGABLE BAY).
314 NYS2d 476-479 (Dist Ct 1970).

Descriptors: *New York, *Permits, *Non-navigable waters, *Dredging, Bays, Regulation, Legislation, Cities, Local governments, State governments, Navigable waters, Beds, Ownership of beds, Sands, Legal aspects, Judicial decisions, Jurisdiction, Regulation.

Defendant was charged with violating a town ordinance prohibiting dredging the bed of a bay without a town permit. Defendant contended that the ordinance was unconstitutionally vague and that only the state, not the town, had the power to control dredging in the bay. The court noted that the standards contained in the ordinance were capable of reasonable application and, moreover, did not affect defendant even if they were vague since defendant had ignored the ordinance and dredged without applying for a permit. The court also held that the bay was not navigable as defined in those statutes vesting control of navigable waters in the state. Even if the water were navigable, the bed under such water was town property, which could be regulated and protected by the town. (Liptak-Florida)
W71-03291

IN RE VILLAGE OF LYNBROOK (VALUE OF LAND CONDEMNED FOR DRAINAGE EASEMENT WHERE OTHER EASEMENTS ALREADY EXIST).
314 NYS2d 404-409 (Sup Ct 1970).

Descriptors: *New York, *Condemnation value, *Easements, *Drainage systems, Condemnation, Eminent domain, Cities, Local governments, Drainage, Property values, Public rights, Public utilities, Parks, Legal aspects, Judicial decisions.
Identifiers: *Drainage easements.

In a county's proceeding to acquire drainage easements beneath land owned by a city, the city contended that the county had no power to acquire the easements by eminent domain. The city also argued that the land should be valued as though taken in fee, since existing easements had never been exercised. The county asserted its statutory authority to acquire drainage easements by condemnation and, as to the land's value, contended that the land was decreased in value by an existing public park easement, even though the land had not been used for park purposes and might never be so used. The court held, first, that the county did have eminent domain power to acquire the land and, second, that the park easement did diminish the land's value, but not to the extent claimed by the county. A decree based on the evidence was entered as to the value of the property. (Liptak-Florida)
W71-03292

FULTON FERRY AND BRIDGE CO V BLACK (LOCAL TOLL BRIDGE FRANCHISE PREEMPTED BY STATE HIGHWAY COMMISSION'S AUTHORITY).

293 SW 2-9 (Ark 1927).

Descriptors: *Arkansas, *Navigable rivers, *Permits, *Bridge construction, Bridges, State governments, Federal government, Rivers, Local governments, Contracts, Roads, Highways, Taxes, Legal aspects, Judicial decisions, Legislation, Administrative agencies, State jurisdiction, Supervisory control (Power).

Plaintiff bridge company sued to enjoin defendant state highway commissioner from building a toll bridge across a navigable river dividing two counties. The county courts of both counties, under their exclusive jurisdiction over roads and bridges, had granted plaintiff a franchise to build the bridge. While plaintiff was seeking the consent of Congress to build the bridge, the state legislature authorized defendant to build the bridge, and Congress gave its consent. Plaintiff contended that the legislature's action was unconstitutional because it invaded the county courts' jurisdiction and impaired the contract rights arising from the franchise. The court held that the county courts' jurisdiction was not violated unless the bridge involved a general tax on the people or required county funds and noted that a toll bridge is not a general tax, but only a tax on those who use the bridge. The court also held that plaintiff's contract was not binding for lack of mutuality since the consent of Congress was a condition precedent to the vesting of any contract rights. (Liptak-Florida)
W71-03293

THE MERCURY POLLUTION PROBLEM IN MICHIGAN AND THE LOWER GREAT LAKES AREA (A SUMMARY OF INFORMATION AND ACTION PROGRAMS),
Michigan Water Resources Commission, Lansing.
For primary bibliographic entry see Field 05G.
W71-03294

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969: INTERIM REPORT NO 1.
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06B.
W71-03295

STATE DISPOSITION OF SUBMERGED LANDS VERSUS PUBLIC RIGHTS IN NAVIGABLE WATERS,
David G. Nelson.
Natural Resources Law, Vol 5, p 491-511, 1970. 21 p, 101 ref.

Descriptors: *Ownership of beds, *Beds under water, *Public rights, *State governments, Riparian rights, Governments, Legal aspects, Judicial decisions, Navigable waters, Estuaries, Damages, Dredging, Landfills, Disposal, Land management, Navigation, Remedies, Federal government, Administrative agencies.

Public interest in submerged lands under navigable waters is of increasing importance today. Discussed herein is a study of legal and political theories for the prevention of the indiscriminate disposal of submerged lands by state governments. A state may convey submerged lands subject to: (1) vested private rights; (2) the navigational power of the federal government; and (3) the rights of the public in the lands and waters remaining within the state. Standing to enforce violations of public rights is also examined. Standing is found when the injury to the individual is different in nature from the injury to the public in general. Federal administrative agencies may often have standing to enforce their paramount rights in navigable waters even though individual rights might not prevail. In spite of legal safeguards, it is concluded that the disposition of submerged lands is subject to the arbitrary and absolute control of state legislatures, subject only to

vested public rights and the paramount federal interest. (Barnett,Florida)
W71-03296

UNITED STATES PROPRIETARY CLAIM TO THE CONTINENTAL SHELF GIVES RISE TO A NEW PUBLIC DOMAIN,
Gregory M. Lattimer.
Land and Water Law Review, Vol 5, p 509-516, 1970.

Descriptors: *Judicial decisions, *Continental shelf, *Federal jurisdiction, *Reefs, Legislation, Tidal waters, Submerged Lands Act, Islands, Beds, Beds under water, Ownership of beds, Land tenure, Legal aspects, United States.

Entrepreneurs, planning to construct an ocean resort complex on a partially submerged reef five miles off the Florida coast, applied for a dredging permit from the Secretary of the Army. Despite denial of the permit, dredging was commenced, and the United States filed suit to enjoin further activity. Defendants contended that the project was outside the United States' territoral jurisdiction. The United States district court held that the reefs were not islands, but seabed, and subject to United States jurisdiction. In examining the ramifications of this decision, United States v Ray, 281 F. Supp. 876 (S.D. Fla. 1965), the author discusses the legal development of the Continental Shelf, dividing it into three zones: territorial waters, high seas, and contiguous waters. 'Seabed' is classified according to three international theories: (1) the view that the seabed is the common property of all nations; (2) the view that the seabed is land presently unappropriated but capable of acquisition; and (3) a combination of these two, classifying seabed as common property and subsoil as capable of acquisition. The author contends that this decision is the beginning of a phase in which the United States will assert plenary control and jurisdiction over the Continental Shelf; this decision is the catalyst for establishment of sovereign rights in the Continental Shelf by the United States. (Hart-Florida)
W71-03297

ESTUARINE CONSERVATION LEGISLATION IN THE STATES (AN EXAMINATION OF SOME EXISTING LEGISLATION AND SOME PROPOSALS),
Milton S. Heath, Jr.
Land and Water Law Review, Vol 5, p 351-390, 1970. 40 p, 65 ref.

Descriptors: *Estuaries, *Conservation, *Legislation, *State governments, Adoption of practices, Grassed waterways, Bays, Estuarine environment, Estuarine fisheries, Inlets (Waterways), Intertidal areas, Saline water-fresh water interfaces, Federal project policy, Water resources development, Legal aspects.

Population growth and consequent pollution have endangered the nation's estuaries, requiring a conservation program. Federal studies have concluded that the states must be the focal point for action to conserve the estuaries. Planning programs and regulations have been adopted in some coastal states. The author discusses the experiences of those states which have begun conservation programs and provides a detailed description of several particularly successful state programs. Statutes proposed for adoption are: (1) an act providing for a comprehensive study of state estuaries, (2) an act providing for permits to dredge or fill in or about estuarine waters, and (3) an act providing for regulation of estuarine dredging and filling by rule-making authority. The purpose and effects of the various statutory proposals are delineated. (Hart-Florida)
W71-03298

PROPOSED SYSTEMS OF COASTAL ZONES MANAGEMENT: AN INTERIM ANALYSIS,
For primary bibliographic entry see Field 02L.
W71-03299

A CAPSULE HISTORY AND THE PRESENT STATUS OF THE TIDELANDS CONTROVERSY,
Austin W. Lewis.
Natural Resources Lawyer, Vol 3, p 620-636, 1970. 16 p, 48 ref.

Descriptors: *Tidal waters, *Leases, *Oil, *Federal-state water rights conflicts, Federal jurisdiction, State jurisdiction, Reservation doctrine, Continental shelf, Submerged Lands Act, Accretion (Legal aspects), Oil wells, Oil fields, Natural gas, Exploration, Mineral industry, Legal aspects, Judicial decisions, Legislation.

The controversy between the federal government and the coastal states over the right to control the tidelands has lasted since 1937. Although the states were originally considered the legal owners of the tidelands, judicial decisions established in the federal government a paramount right, superior to the states' ownership, to control these navigable waters. Various congressional acts partially restored state control over the tidelands, but these acts themselves brought more litigation, primarily over the line on the coast from which state jurisdiction was to be measured. The continuing controversy has resulted in an ambulatory line dividing state-federal jurisdiction, causing split leases of mineral rights, two sets of regulations governing mineral and oil fields, and stringent environmental policy regulations in juxtaposition to extremely lenient or non-existent environmental policies. The overall result is a stifling of oil and gas exploration in the coastal areas. (Hart-Florida)
W71-03300

6F. Nonstructural Alternatives

SPECIAL FLOOD PLAIN INFORMATION STUDY, LUXAPALILA CREEK - TOMBIGBEE RIVER AND TRIBUTARIES, MISSISSIPPI AND ALABAMA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W71-02763

FLOOD PLAIN INFORMATION OF LOWER RIVER ROUGE, WAYNE MICHIGAN AND VICINITY.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
W71-02764

FLOOD PLAIN INFORMATION - LEMON CREEK AT JUNEAU, ALASKA.
Corps of Engineers, Juneau, Alaska.
For primary bibliographic entry see Field 04A.
W71-02765

FLOOD PLAIN INFORMATION OF BIG WOOD RIVER, KETCHUM, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W71-02928

FLOOD PLAIN INFORMATION, MENDENHALL RIVER, JUNEAU, ALASKA.
Corps of Engineers. Alaska District.
For primary bibliographic entry see Field 04A.
W71-03134

THE NATIONAL WATER COMMISSION, ANNUAL REPORT FOR 1969: INTERIM REPORT NO 1.
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06B.
W71-03295

6G. Ecologic Impact of Water Development

SOME CHARACTERISTICS OF THE OPERATIONAL RESERVOIRS IN THE ISRAEL NATIONAL WATER SYSTEM,
For primary bibliographic entry see Field 02H.
W71-02871

LITTORAL ENVIRONMENT OBSERVATION PROGRAM IN CALIFORNIA, PRELIMINARY REPORT FEBRUARY-DECEMBER 1968,
Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-03088

ESTUARINE CONSERVATION LEGISLATION IN THE STATES (AN EXAMINATION OF SOME EXISTING LEGISLATION AND SOME PROPOSALS),
For primary bibliographic entry see Field 06E.
W71-03298

07. RESOURCES DATA

7A. Network Design

PROBLEMS OF EVALUATION OF SOIL MOISTURE FOR WATER BALANCES ON LARGE AREAS,
Technical Univ. of Prague (Czechoslovakia). Soil Science Lab.
For primary bibliographic entry see Field 02G.
W71-02766

REVISION OF THE GAGING STATIONS IN UPPER CEYHAN BASIN, TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
For primary bibliographic entry see Field 02E.
W71-02814

MINIMAL DATA GATHERING PROCEDURE,
West Pakistan Water and Power Development Authority, Lahore.
R. F. Stoner.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 103-115, January 1970. 13 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Water resources, *Data processing, *Statistics, *Foreign projects, Equations, Water resources development.
Identifiers: *West Pakistan, Scarce data.

This paper is concerned with the problem of establishing the minimum amount of water resources data that we can reasonably collect to achieve a defined degree of precision in the end result. Statistical procedures are used throughout, but the presentation deliberately avoids the use of difficult mathematics. While professional statisticians would qualify many of the statements, there are, nevertheless, some broad truths stated and it is hoped that those connected with simple sampling, to whom statistics is a mystery, will be able to appreciate the concepts involved and the procedures for determining the minimum number of samples necessary. These were encountered during the Lower Indus Project investigations which were directed towards formulating an optimum plan for the development of land and water resources in the former Sind area of West Pakistan, an area of approximately 14 million acres. (Woodard-USGS)
W71-02823

HYDROLOGY OF SURFACE WATER IN IRAN,
Ministry of Water and Power, Tehran (Iran). Dept. of Hydrology.
M. Ghazi-Nouri.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 17-27, January 1970. 11 p, 2 fig, 2 tab.

Descriptors: *Water resources, *Water resources development, *Surface waters, *Programs, *Planning, Precipitation (Atmospheric), Watershed management, Evaporation, Runoff, Sediments, Foreign projects, Data collections, Network design, Gaging stations, Hydrologic data.
Identifiers: *Iran, Scarce data.

Procedures are described for collecting and publishing data for river discharge, sediment transport, precipitation and evaporation in the hydrologic network of Iran. Within the twenty years of existence, the Surface Water Department of Iran has achieved great success and the collected data have been successfully used in various development projects throughout the country. Plans for future programs are described. The 1,642,000 sq km area of Iran requires that the hydrologic network be increased, particularly in the central and eastern parts where water deficiency is critical. Future programs of the Surface Water Dept proposed for the fourth Five Year plan include the following new stations: river gaging, 250 staff gages and 100 water level recorders; 100 cableways; rain gages, 70 recording, 350 storage, 300 ordinary; 50 snow course rods; and 70 evaporation stations. For the Meteorological Dept, 500 rain gages and 120 climatological stations are proposed. Also 150 reference stations, 50 agri-climatological and 6 micro-climatological stations are programmed. (Lang-USGS)
W71-02912

HYDROLOGICAL AND RELATED DATA PROGRAMS IN THE UNITED STATES OF AMERICA,
Geological Survey, Washington, D.C.
Raymond L. Nace.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 87-101, January 1970. 15 p, 1 tab, 31 ref.

Descriptors: *Water resources, *Hydrologic data, *Programs, *United States, Surface waters, Groundwater, Streamflow, Runoff, Water table, Dissolved solids, Suspended load, Meteorological data, Network design, Instrumentation, Automation, Remote sensing, Watershed management.
Identifiers: Radiometric data, Hydrological tracers.

About 30 Federal agencies in the United States have sufficient concern with water to collect or pay for the collection of basic data. Most of these agencies obtain data for their own use in their own specific missions, and they do not routinely make data available to others directly or through publication. Two agencies, the Environmental Data Service and the Geological Survey, have primary missions to collect, analyze, interpret and publish data as a public service. It is not feasible to summarize the many kinds of data that are being collected in relation to specific practical problems. Two examples are cited. Soil conservation, erosion control, and watershed management in general are important problems in the United States. The Agricultural Research Service of the U. S. Department of Agriculture has selected 270 experimental watersheds as a sample of the land resources area of the United States. Another significant example of watershed research is that by the U. S. Forest Service in about 250 watersheds dispersed throughout the Nation. Topics reviewed include National Data Coordination, Regional Data Centers, Data Networks and Records, Long-Term Records, Short-Term Records, Network Design, Instruments and Methods, Automation, Remote Sensing, Hydrological Tracers, Geophysical Technology, and conclusions. Hydrological and related data collection networks in the United States are tabulated. (Woodard-USGS)
W71-02918

EVALUATION OF THE STREAMFLOW-DATA PROGRAM IN OREGON,
Geological Survey, Portland, Oreg.
David J. Lystrom.
Geological Survey Open-file Report, 1970. 28 p, 3 fig, 2 plate, 2 tab, 18 ref, append.

Descriptors: *Streamflow, *Evaluation, *Oregon, *Data collections, Planning, Hydrologic data, Precipitation (Atmospheric), Runoff, Gaging stations, Peak discharge, Surface waters, Reservoirs, Rivers, Natural flow, Regulated flow, Regression analysis, Environmental effects, Stream gages.
Identifiers: *Streamflow data (Oreg).

Streamflow data available from 307 gaging stations in Oregon are evaluated and guidelines for planning future programs are provided. Basic steps in the evaluation procedure are (1) definition of the long-term goals of the stream-data program in quantitative form, (2) examination and analysis of all available data to determine which goals have been achieved, and (3) consideration of alternative programs and techniques to meet remaining objectives. Only a few of the goals can be met by generalization of the data now available for gaged basins. Recommendations are made to improve the generalization methods, and deficiencies in the present network are pointed out. Based on the needs described, a new streamflow-data program is proposed. (Woodard-USGS)
W71-02925

A PROPOSED STREAMFLOW DATA PROGRAM FOR WISCONSIN,
Geological Survey, Madison, Wis.
Roy E. Campbell, and Frederick C. Dreher.
Geological Survey Open-file Report, 1970. 55 p, 10 fig, 3 tab, 7 ref, append.

Descriptors: *Streamflow, *Evaluation, *Wisconsin, *Data collections, *Planning, Hydrologic data, Precipitation (Atmospheric), Runoff, Gaging stations, Stream gages, Peak discharge, Rivers, River basins, Natural flow, Regulated flow, Regression analysis, Environmental effects.
Identifiers: *Streamflow data (Wis).

An evaluation of streamflow data from 197 gaging stations in Wisconsin and adjacent areas was made to provide guidelines for planning programs. The basic steps in the evaluation procedure were (1) definition of the long-term goals of the streamflow data program, (2) examination and analysis of all available data to determine which goals have already been met, and (3) consideration of alternate programs and techniques to meet the remaining objectives. Streamflow data were classified according to the type of use or purpose. Recommendations were made as to whether a station should be included in the network or whether it had net the objective for which it was operated and could be discontinued. Recommendations were made as to expanding or initiating studies. Streamflow data collection should be a continuing effort, reoriented as necessary to meet the changing needs. (Woodard-USGS)
W71-02926

POLLUTION SURVEILLANCE AND DATA ACQUISITION USING MULTISPECTRAL REMOTE SENSING,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
For primary bibliographic entry see Field 05A.
W71-03127

7B. Data Acquisition

ON THE QUESTIONS OF RAINFALL MEASUREMENT AND REPRESENTATIVENESS,
Hydrological Research Unit, Wallingford (England).
For primary bibliographic entry see Field 02B.
W71-02777

ESTIMATING THE VOLUME OF AN AQUIFER BY USING CHLORIDE TRACER,
State Hydraulic Works, Ankara (Turkey). Dept. of Research.
For primary bibliographic entry see Field 02F.
W71-02810

WATER BALANCE OF NATURAL UNDERGROUND STORAGE,
Water Research Association, Medmenham (England). Hydrology Div.
For primary bibliographic entry see Field 02F.
W71-02811

A SENSITIVE CUP-TYPE ANEMOMETER,
Washington Univ., Seattle.
Leo J. Fritschen.
Funded in part by the Atmospheric Science Research Division, U. S. Army Electronic and Development Activity, Fort Huachuca, Arizona.
Journal of Applied Meteorology, Vol 6, No 4, August 1967, p 695-698. 4 fig, 1 tab, 8 ref.

Descriptors: *Anemometers, *Research equipment, *Arid lands, *Instrumentation, *Wind velocity, Meteorology, Evaporation, Agriculture, Hydrology, Design, Calibrations, Surfaces.
Identifiers: *Crop surface, *Wind-speed profile.

Wind-speed measurements are important to agricultural, evaporation, hydrological and meteorological research, particularly in arid lands. The sensitive cup-type anemometer described here was designed to measure wind-speed profiles over crop surfaces of limited extent. The simple design uses commercial parts where possible and few electronic components to facilitate rapid dismantling for cleaning. Three 7.6-cm right angle plastic cone cups are mounted at a 7.8-cm arm length. A sensitive relay to interrupting light on a photoconductive cell determines wind speed. Response characteristics are an initial speed of 6 cm per sec, a distance constant of 90 cm, and a linear response over the velocity range tested. Figures include a photograph of the assembly, a sectional diagram of the anemometer transmitter, the anemometer counting circuit, and linear calibration results of cup assemblies. The table of anemometer characteristics show seven features for five cup assemblies. (Popkin-Arizona)
W71-02864

ANNOTATED BIBLIOGRAPHY OF REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-02955

FAO/UNESCO/WMO AGROCLIMATOLOGY SURVEY OF A SEMI-ARID AREA IN WEST AFRICA SOUTH OF THE SAHARA,
Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 02B.
W71-02972

ACETYLENE REDUCTION ASSAY FOR DETERMINATION OF PHOSPHORUS AVAILABILITY IN WISCONSIN LAKES,
Wisconsin Univ., Madison. Dept. of Biochemistry.
W. D. P. Stewart, G. P. Fitzgerald, and R. H. Burris.

National Academy of Sciences, Vol 66, No 4, p 1104-1111, 1970. 2 fig, 8 tab, 17 ref.

Descriptors: *Assay, *Phosphorus, *Wisconsin, *Lakes, Aquatic environment, Surfaces, Diurnal, Thermocline, Storm drains, Eutrophication, Sampling, Cyanophyta, Sulfur, Iron, Magnesium, Photosynthesis, Phosphates.
Identifiers: *Acetylene reduction, Anabaena flos-aquae, Lake Mendota (Wis), Lake Monona (Wis), Lake Wingra (Wis).

Phosphorus-starved cells of Anabaena flos-aquae rapidly increase their capacity to reduce acetylene to ethylene when phosphorus becomes available. This response can be utilized as a bioassay for detecting available phosphorus in aquatic ecosystems. The same standard curve is applicable to all waters tested using the same batch of assay organisms. The sensitivity of the method compares favorably with conventional methods for measuring dissolved orthophosphate, and has the additional advantage that it measures available phosphorus. A failure to detect acetylene reduction in test water samples with added phosphorus is due to some inhibitory factor in the water. The test would not be conclusive in the presence of total inhibitors. The quantitative determination of the amount of available phosphorus in a particular water is more complex. Studies of Wisconsin lakes show that available phosphorus generally is present, that the concentrations are higher at the lower depths than at the surface, and that there may be diurnal variations in the available phosphorus content of surface waters. Important sources of available phosphorus in Lake Mendota are the waters below the thermocline and the input from storm sewers. Biological nitrogen fixation can also be studied with similar equipment. (Jones-Wisconsin)
W71-03024

RAPIDLY LABELED POLYPHOSPHATES AND METAPHOSPHATES IN THE BLUE-GREEN ALGA ANACYSTIS NIDULANS (IN GERMAN),
Technische Hochschule, Hanover (West Germany). Inst. for Botany.
R. Niemeyer, and G. Richter.
English summary. Archiv fur Mikrobiologie, Vol 69, p 54-59, 1969. 3 fig, 10 ref.

Descriptors: *Analytical techniques, *Phosphates, *Algae, Chromotography, Radiochemical analysis, Tracers.
Identifiers: *Anacystis nidulans, Oligophosphates, Metaphosphates, Pulse-labeling, Polyphosphates, Fractionation.

The cells of the blue-green alga Anacystis nidulans were pulse-labeled with phosphorus-32-orthophosphate and grown for 20 hours in phosphorus-free medium. Most of the phosphorus-32 was incorporated into inorganic phosphates which were isolated by joining extraction with the nucleic acid and fractionation on methylated serum albumin and Kieselgur. The column chromtography of the isolate revealed 8 phosphate residues including oligophosphates and circular metaphosphates of thus far unknown origin and function. The trimetaphosphate incorporated considerably more radioactivity than other low-molecular inorganic phosphates. (Wilde-Wisconsin)
W71-03033

SIMULATING THE EFFECT OF SINKING AND VERTICAL MIXING ON ALGAL POPULATION DYNAMICS,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W71-03034

AUTOMATIC RAPID METHOD FOR DETERMINATION OF CARBON AND HYDROGEN (IN GERMAN),
Wolfgang Merz.
English summary. Analytica Chimica Acta, Vol 48, p 381-390, 1969. 7 fig, 1 tab, 10 ref.

Descriptors: *Carbon, *Hydrogen, *Analytical techniques, Organic matter, Oxidation, Titration, Automation.
Identifiers: Carbon monoxide, Carbon dioxide.

The sample of organic matter is burned with manganese dioxide in a stream of oxygen. Combustion products are completely oxidized over copper oxide. The apparatus is flushed with nitrogen, water is frozen out, and carbon dioxide is absorbed in a cell containing an amine in dimethylformamide. The carbon dioxide is titrated with tributylmethylammonium hydroxide. Water is vaporized in a stream of nitrogen and passed over carbon at 1170C. The formed carbon monoxide is oxidized with copper oxide and carbon dioxide is titrated as described. The procedure is entirely automatic and the analysis time for both carbon and hydrogen is 8 minutes. (Wilde-Wisconsin)
W71-03036

ESTIMATES OF SESTON CROPS BY FILTRATION WITH GLASS FIBER DISCS,
Colorado Dept. of Game, Fish and Parks, Glenwood Springs; and Colorado State Univ., Fort Collins. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W71-03051

A SUCTION PIPE FOR SAMPLING MIDWATER AND BOTTOM ORGANISMS IN THE SEA,
SACLANT ASW Research Centre, La Spezia (Italy).
Norberto Della Croce, and Anselmo Chiarabini.
Available from NTIS as AD-854 841, $3.00 in paper copy, $0.95 in microfiche. NATO Technical Memorandum No. 143, May 15, 1969. 13 p.
Identifiers: *Oceanographic equipment, *Samplers, *Acquatic animals, Samplers, *Plankton, Samplers, Surface properties, Sea water, Efficiency, Depth finding, Sedimentation, Underwater sound, Scattering, Pipes, Microorganisms, Compressed air, Ocean bottom, Mediteranean Sea, Ligurian Sea, *Suction pipes.

A suction pipe for sampling mid-water and bottom organisms in the Sea is described. The device can be used from a stationary ship for taking samples at water depths greater than 100 m. If used at the bottom from 25 kg to 50 kg of sediment can be collected in ten minutes, suggesting that the equipment is suitable for quantitative research.
W71-03080

SIMPLE INSTRUMENTATION FOR MEASURING TEMPERATURE GRADIENTS AT THE SEA-AIR INTERFACE, INCLUDING THE RESULTS OF WINTER 1964/65 MEASUREMENTS,
SACLANT ASW Research Centre, La Spezia (Italy).
Allen H. Schooley.
Available from NTIS as AD-472 612, $3.00 in paper copy, $0.95 in microfiche. NATO Technical Report No. 35, July 1965. 24 p.
Identifiers: *Ocean waves, Surface temperatures, *Temperature sensitive elements, Atmospheric temperature, Oceanographic data, Oceans, Instrumentation, Measurement, Heat transfer, Solar Sea water, Italy, Ligurian Sea, Air water interactions, Temperature gradients.

Very little information available on the temperature differates in the first several centimeters of air above the sea surface and the first few centimeters of water below the sea surface. Data of this kind are important in helping to understand heat exchange between the sea and the atmosphere. They may also be a significant factor in the phenomena of sonar surface-reverberation. A series of measurements is now underway to determine the magnitude and fluctuations of these temperate gradients during hourly, daily, and special intervals. These are being made in the open sea off the Ligurian Coast of Italy. The gradients are measured with respect to the actual undulating surface of the sea. The instrumentation being used is described.
W71-03081

AN ECHO INTEGRATOR FOR USE IN THE ESTIMATION OF FISH POPULATIONS,
Washington Univ., Seattle. Fisheries Research Inst.
Henry Wayne Lahore, and Dean W. Lytle.
Available from NTIS as PB-190 367, $3.00 in paper copy, $0.95 in microfiche. Circular No. 70-1, January 26, 1970. 38 p.

Descriptors: Washington.
Identifiers: Fish surveys, Echo integrators, Test fishing, *Fishes, Counting methods, *Echo ranging, Fishes, Population, Abundance, Detectors, Accuracy, Underwater sound, ULTRASONIC RADIATION, Management planning, Efficiency, Theses.

The echo integrator is a sonic device that enables the fishery researcher to quantity fish stocks more accurately than he has been able to do by the use of test fishing and/or an unmodified echo sounder. In this report the fundamentals of underwater acoustics are discussed, the echo integrator is described, and its operation and performance in field experiments are treated.
W71-03083

APPLICATIONS OF ENVIRONMENTAL SATELLITE DATA TO OCEANOGRAPHY AND HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
E. Paul McClain.
Available from NTIS as PB-190 652, $3.00 in paper copy, $0.95 in microfiche. ESSA Technical Memorandum NFSC7M 19, January 1970. 13 p.
Identifiers: *Meteorological satellites, Infrared radiation, *Sea water, Surface temperatures, *Sea ice, Surface temperatures, Infrared photography, Ocean waves, Snow, Wind, Clouds, Weather forecasting, Multiband special reconnaissance, Radiometers, Sea state, Air water interactions, TIROS, Nimbus D Satellite, ATS satellites, Remote sensing.

A research group within the National Environmental Satellite Center is helping to develop applications of environmental satellite data to problems in oceanography and hydrology. Techniques for large-scale mapping of sea surface temperatures in clear and partly cloudy regions are being developed with the aid of high-resolution inflared (HRIR) data from NASA's Nimbus satellites. Digitized television pictures from the ESSA operational satellites and NASA's Application Technology Satellites (ATS) are being studied in conjunction with the relation between sunglint patterns and the ocean wave spectrum and low-level wind stress. New methods for the mapping of major snow and ice boundaries from satellite altitude have been devised and are being tested. The NESC is also involved cooperatively with several Government agencies and NASA in research and applications development in conjunction with the first Earth Resources Technology Satellites.
W71-03085

DETERMINATION OF MERCURY IN WATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W71-03114

MEASURING FOREST EVAPOTRANSPIRATION - THEORY AND PROBLEMS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W71-03122

SOIL HYDRAULIC CONDUCTIVITY MEASUREMENT BY FIELD MONOLITHS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 02G.
W71-03142

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA FOR TEXAS, 1968 - PART 2. WATER QUALITY RECORDS.
Geological Survey, Austin, Tex. Water Resources Div.
For primary bibliographic entry see Field 02K.
W71-02759

A METHOD FOR RUNOFF-MAPPING FROM PRECIPITATION AND AIR TEMPERATURE DATA,
For primary bibliographic entry see Field 02A.
W71-02767

ESTIMATING THE FREQUENCY DISTRIBUTION OF HYDROLOGIC RESIDENCE TIMES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
For primary bibliographic entry see Field 04A.
W71-02770

ESTIMATION AND MAPPING OF EVAPORATION,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 02D.
W71-02774

DATA FOR THE STUDY OF THE WATER BALANCE IN SPAIN (IN FRENCH),
Rafael Heras.
English, Spanish, and Russian abstracts. In: Symposium on World Water Balance, Vol 2, International Association of Scientific Hydrology Publication No 93, p 332-342, July 1970. 11 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Water balance, *Hydrologic data, *Foreign projects, Synoptic analysis, Reviews, Hydrologic cycle, Hydrologic budget, International Hydrological Decade, Meteorology, Precipitation (Atmospheric), Surface waters, Groundwater, Evapotranspiration, Runoff, Streamflow, Water storage.
Identifiers: *Spain.

Methods of utilizing hydrologic data to evaluate water balance in ten hydrographic basins of Spain are presented. Results can be considered as very representative in connection with rainfall, surface flows, regulated volumes, demands, evapotranspiration, and underground waters. Through the comparison of resources and demands, the water balance is established (with reference to the year 1967) to the year 2000. (Woodard-USGS)
W71-02791

SURFACE WATER EVALUATION WITH LIMITED DATA IN THE ARID REGION OF WEST PAKISTAN,
Pakistan Planning Commission, Rawalpindi. Water and Power Div.
For primary bibliographic entry see Field 02E.
W71-02800

A NOTE CONCERNING THE IMPROVEMENT OF THE MEAN ANNUAL RUNOFF MAP OF TURKEY,
Huseyin Conturk.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 407-411, January 1970. 5 p, 17 ref.

Descriptors: *Water resources, *Runoff, *Average flow, *Foreign projects, Precipitation (Atmospheric), Water loss, Water levels, Climatic data.
Identifiers: *Turkey, *Runoff map improvement.

Recently a map of mean annual runoff in Turkey has been published (Conturk and Bayar, 1968). Runoff is presented by isolines in milimeters. To construct the isolines, records of some 450 stream gaging stations having at least one year service life were utilized. Results were adjusted to the basic period 1936-65. (Isenlohr, 1962). No corrections were made, however, for irrigation water losses and other major water losses. In other words, the map represents discharges as they are measured. A number of difficulties were encountered during the development of the map due to limitation of existing data as regards both space and time. Difficulties were smoothed over mostly by subjective handling. Accordingly, the map is approximate and needs improvement. Possible ways of improving annual runoff values in Turkey are defined in this report under the following sub-headings: (a) Estimation of runoff from precipitation; (b) Runoff from precipitation and water losses; (c) Runoff from water levels; (d) Runoff from climatologic and basin characteristics; (e) Runoff from runoff; and (f) Precipitation as an additional variable. (Woodard-USGS)
W71-02805

FREQUENCY ANALYSIS OF RIVER STAGE DATA IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
For primary bibliographic entry see Field 02E.
W71-02807

ZONES AS TO ANNUAL STREAMFLOW VARIATION IN TURKEY,
Electric Power Investigations, Ankara (Turkey). Hydrometric Section.
For primary bibliographic entry see Field 02E.
W71-02815

RAINFALL FREQUENCY ATLAS OF TURKEY,
State Hydraulics Works, Ankara (Turkey). Hydrology Section.
For primary bibliographic entry see Field 02B.
W71-02820

DROUGHT FREQUENCY ANALYSIS BY MEANS OF SYNTHETIC FLOW SEQUENCES,
State Hydraulic Works, Ankara (Turkey). Hydrology Section.
For primary bibliographic entry see Field 02E.
W71-02821

EVALUATION OF WATER RESOURCES WITH SCARCE DATA.
Central Treaty Organization.
For primary bibliographic entry see Field 02A.
W71-02824

SLAB BRIDGE DESIGN AND DRAWING--AN AUTOMATED PROCESS,
Atkins (W. S.) and Partners.
For primary bibliographic entry see Field 08A.
W71-02854

COUNTRY REPORT FOR TURKEY,
Water Operations and Hydrology Lab., Ankara (Turkey).
Korkut Ozal.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 33-36, January 1970. 4 p, 3 fig, 1 tab.

Descriptors: *Water resources, *Hydrologic data, *Foreign projects, Streamflow, Gaging stations, Precipitation (Atmospheric), Evaporation, Temperature, Solar radiation, Humidity, Atmospheric pressure, Wind velocity, Sediments, Watershed management, Lakes, Water balance, Rainfall-Runoff relationships.
Identifiers: *Turkey, Scarce data.

Tables and maps show the types and location of stations and the agencies that are involved in the collection of hydrological and meteorological data in Turkey. Included is a list of the main hydrological publications published in Turkey since the previous CENTO Symposium on Hydrology held in 1966. General statistics concerning the water balance are given. Total runoff is estimated to be 160 milliards cubic meters. In addition, between 6 and 8 milliards cubic meters of groundwater is in storage. Average annual rainfall over the country is about 670 mm, but varies between 160 and 2,500 mm. The data collection network is considered adequate in number of stations but improvement in quality is needed. Three maps, scaled 100 km per in, show (1) runoff in liters per sec per sq km, (2) location of hydrometeorological stations operating and planned, and (3) location of streamflow measuring stations and lake observations in 1966, 1967, and 1968. (Lang-USGS)
W71-02914

MAXIMUM UTILIZATION OF SCARCE DATA IN HYDROLOGIC DESIGN,
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
Leo R. Beard, and A. J. Frederick.
In: Proceedings of Central Treaty Organization Seminar on Evaluation of Water Resources With Scarce Data, March 4-8, 1969, Tehran, Iran, p 129-137, January 1970. 9 p, 4 ref.

Descriptors: *Hydrologic data, *Computers, *Water resources, Computer programs, Data collections, Design data, Synthetic hydrology, Analytical techniques.
Identifiers: *Scarce data, Estimating missing data, Peru, Guatemala.

The minimum amount of recorded information required for a satisfactory analysis depends on the nature of the problem as well as the general statistical features of pertinent hydrologic phenomena. During the early development of electronic computers, principal uses were associated with the processing of large quantities of data. Now there is an important application of computers to work associated with scarce data. This includes elaborate analyses of statistical characteristics of available data and correlations between available data and associated phenomena. Methods that are used for extending available information in time and space, most of which involve the use of electronic computers, are described in this paper. The techniques used in this process extract a maximum amount of information from the available data and extend the information in space and time. Although techniques now developed can aid greatly in design of water structures, it is expected that future experience in their application will expand the utility of these techniques. (Woodard-USGS)
W71-02919

PREPARATION OF LONG TERM FLOW SEQUENCE FROM SHORT TERM RECORD BY STATISTICAL MEANS,
Ministry of Water and Power, Tehran (Iran).
For primary bibliographic entry see Field 02E.
W71-02920

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS, 1965-70,
Texas Water Development Board, Austin.
A. Wayne Wyatt.
Texas Water Development Board Report 121, November 1970. 361 p, 54 ref.

Descriptors: *Groundwater, *Water wells, *Hydrologic data, *Water levels, *Texas, *Data collections, Aquifers, Water level fluctuations, Observation wells, Hydrographs, Water table, Depth, Elevation, Aquifer characteristics, Drawdown, Pumping.
Identifiers: *Well data, *Water-level measurements, *Southern High Plains (Tex).

Water-level records (1965-70) from approximately 1,500 wells which are located in 32 counties in the Southern High Plains of Texas are presented. The Ogallala Formation, the major aquifer underlying the Southern High Plains, varies in total thickness from a few feet to more than 500 feet in the approximately 31,000 square miles covered. A large upper part of this formation, however, is not saturated with water. The saturated thickness of the formation varies from less than 20 feet to more than 300 feet. Most of the wells from which water-level data are obtained are in areas of large withdrawals of groundwater for irrigation, industrial, and municipal use. The principal long-term changes in water levels have relfected decreases in the overall volume of water stored in the aquifer. Information concerning data tabulated for each well includes the well number, depth of well, elevation of land surface in feet above mean sea level, dates of measurement, measurements of water level in feet below land surface, and changes (decline or rise) in water level from the previous year's measurement. Hydrographs, showing changes in water level, are presented for selected representative wells following the respective county tabulations. (Woodard-USGS)
W71-02921

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65: PART 9. COLORADO RIVER BASIN - VOLUME 2.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, Government Printing Office, Wash, DC 20402 - Price $3.25. Geological Survey Water-Supply Paper 1925, 1970. 618 p, 1 fig, 1 plate.

Descriptors: *Hydrologic data, *Surface waters, *Streamflow, *Flow measurement, *Gaging stations, Colorado River basin, Data collections, Average flow, Low flow, Peak discharge, Lake stages, Reservoir stages, Stream gages.
Identifiers: *Streamflow basic-data.

Records of stage, discharge, and content of streams, lakes, and reservoirs in the Colorado River basin from the Green River near Daniel, Wyo., to the Colorado River at Compact Point, Ariz., are presented for the period October 1, 1960 to September 30, 1965. The tables of data include a description of the gaging station and tables showing daily, monthly, and yearly discharges of the stream. The table heading gives the station location, drainage area, records available, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. For some reservoirs a table showing daily contents or stage is given. A skeleton table of capacity at given stages is published for all reservoirs for which records are published on a daily basis. Data for partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. Occasionally, a series of discharge measurements are made within a short time period to investigate the seepage gains or losses along a reach of a stream or to determine the low-flow characteristics of an area. Such measurements are given in special tables following the tables of partial-record stations. (Woodard-USGS)
W71-02924

MISCELLANEOUS STREAMFLOW MEASUREMENTS IN IDAHO, 1894-1967,
Geological Survey, Boise, Idaho.
S. O. Decker, R. E. Hammond, and L. C. Kjelstrom.
Geological Survey Basic-data Release, 1970. 310 p.

Descriptors: *Surface waters, *Discharge measurement, *Data collections, *Idaho, Hydrologic data, Streamflow, Springs, Gaging stations, Watersheds (Basins), Water resources, Flow rates, Stream gages, Peak discharge, Inflow.
Identifiers: *Streamflow basic-data report, *Upper Columbia River Basin, *Snake River Basin, *Great Salt Lake Basin, Miscellaneous sites.

Presented is a compilation of all available streamflow measurements made in Idaho from 1894 to 1967 at miscellaneous sites and at crest-stage stations, including peak discharges at partial-record stations. Some sites are located in adjacent States on streams which enter Idaho. Each site has been assigned a number to conform to the US Geological Survey's gaging station numbering system. The number, name, location, discharge measurements, the stream or lake it is tributary to or diverts from, and other available data for each site are given and are arranged in downstream order. (Woodard-USGS)
W71-02927

ESTIMATING THE ACCURACY OF STATISTICAL FLOOD VALUES BY MEANS OF LONG-TERM DISCHARGE RECORDS AND HISTORICAL DATA,
For primary bibliographic entry see Field 02E.
W71-02939

ON THE METHOD OF UNIT HYDROGRAPH AND MODELLING OF RAINFALL FLOODS BY ELECTRONIC ANALOGUE COMPUTERS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02944

COMPUTATION PRINCIPLES OF FLOOD HYDROGRAPHS,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02A.
W71-02945

INCREASING THE ACCURACY OF DETERMINATION OF MAXIMUM DISCHARGES AND THEIR EXCEEDENCE PROBABILITY,
For primary bibliographic entry see Field 02E.
W71-02947

EXTRAPOLATION OF DISCHARGE RATING CURVES USING CHEZY'S FORMULA,
State Hydrological Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02E.
W71-02948

THE WATER ENCYCLOPEDIA.
California Univ., Berkeley. Dept. of Civil Engineering.

David Keith Todd, Editor. Water Information Center Publication, Port Washington, New York, 1970. 559 p, 52 fig, 387 tab.

Descriptors: *Data collections, *Hydrological data, Water resources, Climates, Precipitation (Atmospheric), Water balance, Snowpacks, Snowmelt, Hydrologic cycle, Interception, Infiltration, Runoff, Consumptive use, Erosion, Sedimentation, Evapotranspiration, Evaporation, Streamflow, Surface waters, Groundwater, Groundwater movement, Water wells, Aquifers, Water utilization, Irrigation water, Industrial water, Municipal water, Water quality, Water pollution control, Water reuse, Sewage treatment, Water resources development, Water management (Applied), Governments, Legal aspects, Regulation, Water resources research act, Water properties, Physical properties.
Identifiers: *Water resources encyclopedia, *Water encyclopedia.

This reference volume contains a variety of world water resources data, facts, and statistics presented in 550 pages of tables. The subject matter includes climates, hydrology, surface and groundwater resources, water use and needs, and water quality. In addition, information on water resources agencies and constants and conversion factors is presented. Information is presented in tabular form; the only text consists of explanatory notes and footnotes to make the material readily understandable. To facilitate the rapid location of specific data, particular attention was given to making the index as complete as possible. Time-dependent data, such as hydropower development in the United States, are identified by date. The 9 chapters discuss climate and precipitation, hydrologic cycle elements, surface water, groundwater, water use, water quality and pollution control, water resources management, agencies and organization, and constants and conversion factors. (Knapp-USGS)
W71-03116

A STUDY OF WASTEWATER IRRIGATION THROUGH COMPUTER SIMULATION,
Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05D.
W71-03126

CREST-STAGE GAGING STATIONS IN OREGON - A COMPILATION OF PEAK DATA COLLECTED FROM OCTOBER 1952 TO SEPTEMBER 1970,
Geological Survey, Portland, Oreg.
John Friday.
Geological Survey Open-file Report, October 1970. 71 p, 1 fig.

Descriptors: *Hydrologic data, *Peak discharge, *Gaging stations, *Oregon, Discharge (Water), Data collections, Runoff, Floods, Streamflow, Stream gages.
Identifiers: *Crest-stage gages, Peak flow.

This report contains a compilation of peak-flow data collected at crest-stage gaging stations in Oregon. Selected streams are gaged and the resulting data are used in a statistical analysis to generalize peak-flow characteristics. The peak data are the results of determining water-surface elevations (gage heights) at drainage structures and relating the gage heights to peak flow. Many of these structures are highway culverts, but small dams and bridges are also used. The structures provide a stable control for which a stage-discharge relation can be developed, and they also provide a means for computing the discharge in the event current-meter measurements cannot be made. Gaging-station records consist of a brief description of the location and physical features of each site, and a compilation of the peak data collected through the period of record. Basin characteristics, such as the mean elevation of the basin, channel slope, and the vegetal and geological features, are given if they have been evaluated. A total of 147 station records are compiled. Their locations are shown on a map. (Knapp-USGS)
W71-03133

GROUNDWATER ANALOGUES,
Melbourne Univ., Parkville (Australia). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 02F.
W71-03135

HYDROGEOLOGIC ELECTRIC ANALOGUE MODELS CONSTRUCTED BY THE SOUTH AUSTRALIAN MINES DEPARTMENT,
South Australia Dept. of Mines.
For primary bibliographic entry see Field 02F.
W71-03137

DIGITAL MODELS IN REGIONAL GROUNDWATER STUDIES,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03138

WIND EROSION EQUATION: COMPUTER SOLUTION AND APPLICATION,
Agricultural Research Service, Manhattan, Kans. Div. of Soil Erosion; and Kansas State Univ., Manhattan. Dept. of Statistics and Computer Science.
For primary bibliographic entry see Field 02J.
W71-03140

08. ENGINEERING WORKS

8A. Structures

THE STRESS DISTRIBUTION OF NORFORK DAM,
California Univ., Berkeley. Inst. of Engineering Research.
Ray W. Clough.
Available from NTIS as AD-701 898, $3.00 in paper copy, $0.95 in microfiche. Final Rept. to U.S. Engineering District, Little Rock, August 1962. 133 p. Rept. No. Ser-100-Issue-19, 9 ref.
Identifiers: *Dams, Stresses, Foundations (Structures), Loading (Mechanics), Reinforced concrete, Cracks, Shear stresses, Thermal stresses, Crack propagation, Mathematical models, Arkansas, Computer analysis, Computerized simulation, Finite element analysis, Norfolk Dam.

The stress distribution was investigated within the cross-section of a gravity dam. The analysis was performed by an automatic digital computer, using the finite element method. The principal purpose of the study was to determine the effect on the stress distribution of a vertical crack extending from the center of the base through most of the height of the section. The dam was subjected to dead load, live load, and thermal stress conditions; a total of 17 different loading and crack configurations were considered, including cases in which the foundation material was assumed to be orthotropically elastic.
W71-02841

LIMIT STATE DESIGN--A UNIFIED PROCEDURE FOR THE DESIGN OF STRUCTURES,
National Research Council of Canada, Ottawa (Ontario).
D. E. Allen.
Engineering Journal (Canada), Vol 53, No 2, p 18-29 and 35, Feb 1970. 13 p, 4 fig, 2 tab, 27 ref, 3 disc.

Descriptors: *Limit design, Load factors, *Structural design, Optimum design, Structural engineering, Bibliographies, Design criteria, Design, Foreign design practices, Structural analysis, Probability, Live loads, Safety factors, Dead loads.
Identifiers: *Design practices, Procedures, Canada, Allowable stress.

Limit state design is a unified procedure of design calculations for steel, reinforced concrete, wood, masonry, and soil structures. The method has been used in the USSR since 1954, and is being adopted in Europe for reinforced concrete design. Primary emphasis in limit state design is on the structural conditions that must be designed for--the limit states. Using partial safety factors leads to more intelligent safety considerations and greater economy; load factors and material or dimension factors are applied directly to the parameters to which they belong. Limit state design differentiates between dead load which promotes failure and carries an overload factor, and dead load which prevents failure and carries an underload factor; in regard to stability and stress reversal, safety is automatically assured without the need for special requirements. Examples of limit state design of a column and a simply supported beam or slab are given. Reasons for the increasing popularity of limit state design over existing procedures are given; shortcomings of existing design rules, criteria for structural design, and optimum design are reviewed. (USBR)
W71-02850

EARTHQUAKE RESPONSE OF CONCRETE GRAVITY DAMS,
California Univ., Berkeley.
A. K. Chopra.
Proc Amer Soc Civ Eng, J Eng Mech Div, Vol 96, No EM4, p 443-454, Aug 1970. 12 p, 4 fig, 3 tab, 15 ref, 2 append.

Descriptors: Dams, *Concrete dams, *Gravity dams, Dam design, Safety, *Earthquakes, Earthquake engineering, Structural behavior, Vibrations, Linear systems, Seismic design, Lateral forces, Fourier analysis, Earth movements, Numerical analysis, Analytical techniques, Two-dimensional, Equations, *Displacements, Bibliographies.
Identifiers: Earthquake control, Earthquake loads, Frequency response, *Dynamic response, Hydrodynamic pressures, Finite element method.

Earthquake response is simplified to a linear analysis of the 2-dimensional vibration of coupled reservoir-dam systems, with the response of the dam being approximated by deformations in the fundamental mode. Four cases considered are: (1) dam alone (without reservoir); (2) reservoir-dam system--interaction neglected; (3) reservoir-dam-system--interaction included; and (4) reservoir-dam system-interaction included, but water compressibility neglected. Expressions for the complex frequency response functions for the dam displacement and lateral hydrodynamic force in each of the 4 cases are presented. The results and the Fast Fourier Transform algorithm are used to compute the time-history of responses of 28 reservoir-dam systems to the Taft, Calif earthquake of 1952. Conclusions are: (1) the presence of the reservoir may increase the dam response significantly, and (2) the commonly used simpler analyses which neglect reservoir interaction or compressibility of water may result in significant error. (USBR)
W71-02853

SLAB BRIDGE DESIGN AND DRAWING--AN AUTOMATED PROCESS,
Atkins (W. S.) and Partners.
G. G. Aperghis.
Institution of Civil Engineers Proceedings, Vol 46, p 55-75, May 1970. 21 p, 11 fig, 7 tab, 16 ref.

Descriptors: *Bridge design, Bridges, *Slabs, Reinforced concrete, Cost comparisons, Prestressed concrete, *Computer programs, Drawing, Foreign design practices, Analytical techniques, Loads (Forces), Costs, Bibliographies, Optimization, Optimum design.
Identifiers: *Concrete slabs, *Computer-aided design, Drawings, Design improvements, Finite element method, Great Britain, Cost savings.

Significant improvements in slab bridge design achieved by using a computer program that analyzes, designs, details, and draws right or skew slabs of reinforced or prestressed concrete are described. The program incorporates: (1) accurate analysis based on the finite element method; (2) extensive treatment of loading; (3) thorough investigation of different methods of prestressing or placing reinforcement; and (4) optimization procedures for minimizing materials costs. Input data comprise the essentials for a particular application such as slab geometry, traffic and pedestrian arrangement, loading intensities, and materials properties; general data such as code specifications are stored in the program. Output consists of a printout of a bar schedule and supporting calculations and a construction drawing produced by a digital plotter. Accurate analysis and extensive loading treatment permit more confidence in the design, and optimization procedures result in better and lower cost bridges. Materials costs are compared for a bridge design using the computer program and using manual design methods. (USBR)
W71-02854

THE SAN SIMON WATERSHED; HISTORICAL REVIEW,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 02J.
W71-02874

EFFECTS OF STREAM STRAIGHTENING ON FLOOD RUNOFF CHARACTERISTICS,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 04A.
W71-02881

THE TWICE-USED WATER,
For primary bibliographic entry see Field 02F.
W71-02959

TURBODRILL SOLVES TOUGH, COSTLY OPERATING PROBLEMS,
Compagnie Francaise des Petroles, Paris (France). Drilling Dept.
A. Brun.
World Oil, Vol 169, No 2, p 35-38, August 1969. 2 tab, 5 fig, 4 ref.

Descriptors: *Drilling, *Drilling equipment, Oil wells.
Identifiers: *Turbodrilling, *Drilling economics, *Drilling research, France, Rotary drilling versus turbodrilling, Energy delivery, Specific power transmission.

Broad application of turbodrills has proved tool's value for reducing trip frequency, increasing pentration rates, cutting costs, and for solving downhole drilling problems. On one test, a turbodrill completed a 6000 foot hole in 7 3/4 days whereas a standard rotary drill required 18 1/2 days to do the same job at the same location. The primary target of every drilling operation is to remove rock off bottom to make hole. Different forms of energy can be used: mechanical, hydraulic, thermal, chemical, nuclear, etc. Only mechanical and hydraulic energy are used at present. The specific power concept helps to confirm the value of the turbodrill. The specific power of a bit is energy transmitted to the bit divided by the section of the hole. It can be expressed by horse power per square inch. Figures are offered which illustrate that cable tools and classical rotary have relatively poor capability when compared to the turbodrill. (Campbell-NWWA)
W71-02983

THE SIMULATION OF PERCUSSION DRILLING IN THE LABORATORY BY INDEXED-BLOW STUDIES,
Pennsylvania State Univ., University Park.
H. L. Hartman, and Tze Chao.
Society of Petroleum Engineers Journal, p 214-226, September 1963. 1 tab, 12 fig, 9 ref.

Descriptors: *Rock properties, *Drilling, *Mining engineering, Rock mechanics, Boreholes, *Drilling research.
Identifiers: *Percussion drilling, Indexed-blow studies, Laboratory tests, Bedford limestone, Indiana, Indexing characteristics of chisel bits, Strain-time histories, Maximum strain relationships, Cable tool drilling.

The drop tester has proved an invaluable tool for the investigation of percussion drilling in the laboratory in 'slow motion'. It has allowed the process of rock penetration by impact to be studied a single blow at a time. In the present work, the relation of cratering to indexing has been determined under conditions simulating those in the bottom of the hole at atmospheric pressure. Indexed blows form craters which are influenced by others adjacent to them. Two unique effects are involved; (1) the provision of additional free faces in proximity to the point of impact and (2) the creation of subsurface damage by the previous blows. Both have a pronounced influence on the volume of rock removed per blow, which governs the rate of penetration in actual drilling. A single blow approach also has value in cable tool drilling. The results of this study are; (1) the optimum index distance on a damaged surface is greater than on a fresh, undamaged rock surface; (2) the volume of

rock broken at optimum index distance is about the same for both surface with wedge; (3) the optimum index distance and maximum crater volume are proportional to the energy level; (4) at a given energy level, the volume of rock broken by dies generally exceeds that by wedges; and (5) maximum crater volume varies, approximately, inversely with width of die but is nearly independent of included angle of wedge. (Campbell-NWWA)
W71-02997

DRILLING.

Transactions of the Society of Petroleum Engineers, AIME, 1963. 295 p, 78 ref.

Descriptors: *Rock properties, *Drilling fluids, *Rotary drilling, *Oil industry, Boreholes.
Identifiers: *Core barrel, *Soft rock drilling, Air drilling, Drill bit performance, Tool joint stress, Unconsolidated oil sands.

Thirty-one papers are included covering fundamental rock properties and breakage, and factors affecting drill bit performance, drilling fluids and problems of rheology, hydraulics and air drilling. Experimental stress analysis on tool joints in rotary drilling is examined as well as the development and field testing of core barrels for recovery in unconsolidated oil sands. An engineering appraisal of small diameter hole drilling in soft rock formations is also presented. (Campbell-NWWA)
W71-02998

EIGHT STEPS TO STOP LOST CIRCULATION,
Magnet Cove Barium Corp., Ark.
B. Q. Green.
Petroleum Engineer, Vol 35, No 3, p 100-111, March 1963. 2 fig.

Descriptors: *Oil wells, *Water wells, *Rotary drilling, Drilling fluids, Mud, Texas, Florida, Kansas, Louisiana.
Identifiers: *Lost circulation prevention, *Circulation thief zone, Mud pressure, Lost circulation materials, Texas, Louisiana, Kansas, Florida, Mud viscosity adjustment.

Eight ways are discussed to stop lost circulation, eg., (1) pull up bit and wait 4 to 8 hours for natural plugging, (2) reduce pressure and adjust mud viscosity, (3) batch squeeze with proper particle size, (4) locate points of loss and squeeze again, (5) increase maximum particle size of lost circulation material, (6) use special sizes and shapes of lost circulation material, (7) use reinforcing materials and (8) set protective casing. All lost-circulation problems in rotary drilling can be prevented if the effective downhole pressure can be reduced to equal the formation pressure. In areas where circulation losses are gradual rather than sudden, from 3 to 5 pounds per bbl of fine mica and/or nut shells for example should be carried with the mud to increase flow capacity of natural mud solids to bridge micro-openings that may grow into major circulation loses. Engineers have solved most of the severe lost circulation problems. A reduction of 50 to 90% has been realized in some areas. This success was due to considerations of (1) better casing programs (2) improved mud-weight control (3) better control of flow properties and (4) improved rig techniques. (Campbell-NWWA)
W71-02999

HOW TO COMBAT LOST CIRCULATION (PART 2).
National Lead Co., Houston, Tex. Baroid Div.

World Oil, Vol 155, No 3, p 80-90, August 1962. 5 fig.

Descriptors: *Oil wells, *Rotary drilling, Wells, Drilling fluids.
Identifiers: *Lost circulation, *State-by-state characteristics, Improved mud techology, Improved hydraulics and equipment handling techniques.

Lost circulation characteristics vary in different areas of the United States but the problems are being reduced by understanding the causes and by using improved mud technology, hydraulics and equipment handling techniques. The Gulf Coast area is of special concern. Loss of mud occurs in gravel beds, cavernous and highly permeable limestone and natural or induced fractures and fissures. Mud loss has been stopped with fibrous or flake materials especially designed as lost circulation materials. Cavernous and vugular formations that cause difficulty are coral beds. Drilling without return has been an accepted practice and blind drilling allows large volumes of water to be pumped into the hole, carrying the cuttings into the caverns. Surface casing is set when a depth is reached beyond which circulation can be expected. Methods and problems encountered have application to shallow exploration drilling for water or other minerals of economics interest. (Campbell-NWWA)
W71-03001

HOW MUCH CAN YOU PULL ON STUCK DRILL PIPE,
Pan American Petroleum Corp., Tulsa, Okla.
J. C. Stall, and K. A. Blenkarn.
World Oil, Vol 155, No 6, p 91-96, November 1962. 8 tab.

Descriptors: *Oil wells, *Rotary drilling, Wells, Drilling equipment, Drill monitors.
Identifiers: *Peak load, *Peak torque, *Stuck drill pipe, Allowable hook load calculations, Tensional strains, Torsional strains, Safe drilling procedure.

Calculations based on fundamental relationships are given on allowable hook load and torque combinations for commonly used drill pipe, including tool joints, subjected to combined tension, torsion and internal stress pressures. Strengths are given for both new and used pipe, and tables are based on minimum yield strengths. These calculations allow for normal circulating pressures, but do not allow for weakening effects of fatigue cracks, corrosion, or hydrogen embrittlement. Calculations and fundamental relationships have application to shallow exploration drilling for water or other economic minerals. (Campbell-NWWA)
W71-03002

THE THEORETICAL APPROACH TO TURBODRILLING,
Bureau de Coordination Technique, Paris (France).
W. Tiraspolsky.
World Oil, Vol 145, No 6, p 119-126, November 1957. 4 fig.

Descriptors: *Drilling, *Drilling equipment, Oil wells.
Identifiers: *Turbodrilling, *Drilling research, France, Germany, Russia.

Mechanical comparisons, illustrated with graphs of turbo and conventional drilling methods, indicates increased possibility of applying turbodrilling to industrial needs. Use and manufacture of turbodrills is discussed as well as its field application via favorable penetration rates compared with conventional rotary drilling methods. Historical development of the turbodrill is explored with emphasis on its future use. (Campbell-NWWA)
W71-03003

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES: BRIDGE CONSTRUCTIONS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 08B.
W71-03010

DETERMINATION OF DEPTH IN STILLING BASINS,
Bureau of Reclamation, Denver, Colo.
A. I. Kostin.
Translation of: Gidrotekhnicheskoe Stroitel'stvo, No 5, p 44, 1965. Available from NTIS as PB-193 621T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 690, August 1967. 5 p, 1 fig.

Descriptors: *Stilling basins, Two dimensional, Hydraulics, Hydraulic structures, Hydrodynamics, Friction, Aprons, Velocity, Mathematical analysis, Water, Calculations, Flow resistance, Tailrace, Hydraulic jumps, Submergence, Fluid flow.
Identifiers: *Water depth, Foreign research.

A formula is derived for approximately calculating the water depth of a stilling basin with a baffle block. The formula may also be used for approximately calculating the water depth of a tailrace when no stilling basin is required. In practice, the error in determining water depth does not exceed 2 percent.
W71-03191

PLAN OF CHIRKEISK HYDROELECTRIC POWERPLANT ON THE SULAK RIVER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08C.
W71-03194

TECHNICAL PLAN FOR EXPLOSIVE CONSTRUCTION OF BAIPAZINSK DAM ON THE VAKHSH RIVER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08H.
W71-03195

ADVISORY CONFERENCE ON TUNNELLING, JUNE 22-26, 1970, WASHINGTON, D.C. ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD): WORKING PAPERS.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286, $10.00 in paper copy, $0.95 in microfiche. June 1970. 607 p.
Identifiers: *Underground structures, Construction, *Construction, Symposia, Earth-handling equipment, Geology, Hydrology, Underwater equipment, Foreign policy, Costs, Questionnaires, Mining engineering, Transportation, Electric power production, Urban planning, Environment, *Tunneling-excavation, Demand (Economics), Public utilities, Management information systems.

Hard rock tunnelling, by T E Howard, Cut-and-cover construction, by J Schmidbauer; Soft-ground tunnelling, by J Deschamps; Immersed tunnel construction, by H C Wentink; Conference recommendations; Tunnelling demand 1960-1980; Research and development related to tunnelling. (See also W71-03209 thru W71-03215)
W71-03208

HARD ROCK TUNNELLING,
Organization for Economic Co-Operation and Development, Paris (France).
Thomas E. Howard.
Available from NTIS as PB-193 286-1, $3.00 in paper copy, $0.95 in microfiche. 72 p.
Identifiers: *Underground structures, *Construction, *Rock Geology, Drilling, Symposia, Questionnaires, Foreign policy, Geophysical prospecting, Mathematical prediction, Supports, Machines, Hydrology, Mechanics, Handling, Safety, Standardization, *Tunneling Excavation, *Hard rock tunneling, Management information systems, Technological improvement, Rock mechanics.

The report is intended to facilitate the orderly development of tunneling technology by focusing attention on the inadequacies of rock tunneling and the improvements that are needed. The data presented were derived from the results of a comprehensive questionnaire that was completed by individuals and organizations in 17 countries. (See also W71-03208)

W71-03209

CUT-AND-COVER CONSTRUCTION,
Organization for Economic Co-Operation and Development, Paris (France).
J. Schmidbauer.
Available from NTIS as PB-193 286-2, $3.00 in paper copy, $0.95 in microfiche. 61 p.
Identifiers: *Underground structures, *Construction, *Earth-handling equipment, Efficiency, Beams structural, Walls, Soil mechanics, Noise, Drilling, Hydrology, Problem solving, Foreign policy, Questionnaires, Symposia, *Cut and cover construction, Management information systems, *Tunneling excavation, Technical improvement.

The document is concerned with the cut-and-cover construction method which is much more frequently employed for building road tunnels in cities than are rock and soft-ground tunnelling. The purpose of the questionnaire was to promote the development of this method of construction and propose necessary improvements in view of the considerable amount of construction that will take place in the future. (See also W71-03208)
W71-03210

SOFT-GROUND TUNNELLING,
Organization for Economic Co-Operation and Development, Paris (France).
J. Deschamps.
Available from NTIS as PB-193 286-3, $3.00 in paper copy, $0.95 in microfiche. 129 p.
Identifiers: *Underground structures, *Construction, *Soils, Removal, Hydrology, Soil mechanics, Problem solving, Earth-handling equipment, Handling, Safety, Systems engineering, Symposia, Questionnaires, Foreign policy, *Tunneling, Excavation, *Soft ground tunneling, Management information systems, Technological improvement.

The report, which forms part of the enquiry undertaken by the Organization for Economic Cooperation and Development (O.E.C.D.) is concerned with the present-day inadequacies and improvements needed in the technology of softground tunneling. It is based on replies received from 17 countries, including the United States. (See also W71-03208)
W71-03211

IMMERSED TUNNEL CONSTRUCTION,
Organization for Economic Co-Operation and Development, Paris (France).
H. C. Wentink.
Available from NTIS as PB-193 286-4, $3.00 in paper copy, $0.95 in microfiche. 42 p.
Identifiers: *Underground structures, *Construction, *Assembling, Underwater, Steel, Cylindrical bodies, Coatings, Positioning devices, Machinery, United States, Rectangular bodies, Reinforced concrete, Western Europe, Geology, Hydrology, Soil mechanics, Symposia, Questionnaires, *Tunneling Excavation, *Immersed tunnels, Management information systems, Technological improvement.

The document is concerned with tunnels composed of elements constructed in a dry-dock or on a slipway and subsequently transported to the construction site, where they are sunk, placed on a foundation, and connected together under water. The questionnaire dealing with immersed tunnels brought in replies from twelve countries, many of which were based only on a theoretical knowledge of the subject or on experience with tunnels of very small cross-section. (See also W71-03208)
W71-03212

CONFERENCE RECOMMENDATIONS.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286-5, $3.00 in paper copy, $0.95 in microfiche. 19 p.
Identifiers: *Underground structures, *Construction, Symposia, Cost effectiveness, Data processing systems, State-of-the-art reviews, Mathematical analysis, Geophysical prospecting, Law, Contracts, Public relations, Industrial training, Foreign policy, Urban planning, Recommendations, Management information systems, Technological improvement, *Tunneling Excavation, Benefit cost analysis.

The document contains recommendations concerning factors which have contributed to a reduced rate of progress in the art of tunneling. The object to be achieved is that of making the best use of tunneling in the interests of society. (See also W71-03208)
W71-03213

TUNNELLING DEMAND 1960-1980.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286-6, $3.00 in paper copy, $0.95 in microfiche. 131 p.
Identifiers: *Underground structures, *Construction, *Economics, Underground structures, Statistical data, Factor analysis, Classification, Reviews, Costs, Approximation mathematics, Predictions, *Tunneling excavation, Demand economics, Management information systems.

The body of the report consists of four sections: a summary of a major findings and conclusions, an 18-country analysis of the data pertaining to underground excavation activities during the period 1960-1969, a comprehensive analysis of the data pertaining to the predicted demand for underground excavation during the period 1970-1979, and an analysis of the trends in the evolution of comprehensive tunneling demand over the period 1960-80. (See also W71-03208)
W71-03214

RESEARCH AND DEVELOPMENT RELATED TO TUNNELLING.
Organization for Economic Co-Operation and Development, Paris (France).

Available from NTIS as PB-193 286-7, $3.00 in paper copy, $0.95 in microfiche. 105 p.
Identifiers: *Underground structures, *Construction, Symposia, Questionnaires, Research program administration, Structures, Terrain, Organizations, Foreign policy, Statistical data, Costs, Classification, *Tunneling excavation, Research and development, Management information systems.

The document is concerned with the status of applied research and development relating to tunneling technology. Applied research and development means theoretical and experimental studies of new design methods and construction techniques including studies of the properties, character and behavior of tunnel structures and of the ground mass in which they are constructed. (See also W71-03208)
W71-03215

8B. Hydraulics

SPILLWAY DESIGN FLOOD FOR DAMS IN IRAN,
Iran Plan Organization, Tehran.
For primary bibliographic entry see Field 04A.
W71-02809

FLOW SEPARATION IN TIME VARYING FLOW,
Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.
Fang-Kuo Chou, and V. A. Sandborn.
Available from NTIS as AD-700 926, $3.00 in paper copy, $0.95 in microfiche. Project THEMIS Technical Report No 6, December, 1969. 62 p, 3 tab, 15 fig, 21 ref. ONR N00014-68-A0493-0001.
Identifiers: *Flow separation, Boundary layer, Shear stresses, Relaxation time, Pipes, Velocity, Correlation techniques, Flat plate, Models, Periodic variations, Themis project, Shear flow.

An exact solution of time varying pipe flow with a fluctuating velocity superimposed on the mean flow is analyzed. The velocity profiles, together with the profile parameters at separation, are computed from a computer program. The results are compared with the model for relaxed (steady) and unrelaxed (unsteady) separation criteria proposed by V A Sandborn and S J Kline. For very low frequencies, the correlation curves appear to have a reasonable agreement with the proposed relaxed separation criterion. For high frequencies, the correlation curves were found to fall approximately on the unrelaxed separation criterion. This result demonstrates further that adjustment time is an important factor for separation to be relaxed or unrelaxed, a new concept proposed by Sandborn. In addition, J T Stuart's solution for the flow along an infinite flat plate with normal suction and periodic external velocity is further analyzed. The results again prove to agree with the proposed new concept.
W71-02835

OBSERVATIONS OF DEEP-WATER RENEWAL IN THE CARIBBEAN SEA,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 02A.
W71-02897

SIGNIFICANCE OF CAMILLE (1969),
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02B.
W71-02908

IMPACT-TYPE ENERGY DISSIPATOR FOR STORM-DRAINAGE OUTFALLS STILLING WELL DESIGN.
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
W71-02954

FLOW CONCENTRATION GROINS FOR REAERATION IN PASSAIC RIVER - A HYDRAULIC MODEL STUDY,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W71-03009

SUBCRITICAL FLOW AT OPEN CHANNEL STRUCTURES: BRIDGE CONSTRUCTIONS,
Utah Water Research Lab., Logan.
Gaylord V. Skogerboe, Lloyd H. Austin, and Kuan-Tao Chang.
Available from NTIS as PB-196 477, $3.00 in paper copy, $0.95 in microfiche. Partial Technical Completion Report, Utah Center for Water Resources Research, Logan, Report PRWG 71-2, September 1970. 153 p, 3 tab, 41 fig, 27 ref, append. OWRR Project B-018-UTAH (2).

Descriptors: Backwater, *Bridges, *Energy losses, Head loss, Hydraulic design, *Hydraulic structures, Non-uniform flow, *Open channel flow, Subcritical flow.

Techniques previously employed for describing subcritical flow at open channel constrictions have been found valid for analyzing nonuniform flow in open channels. Combining the nonuniform flow analysis with the submerged flow ratings for various bridge geometries has provided an analytical means for determining the backwater due to the bridge constriction under 'abnormal stage-discharge' conditions. (See W69-00989, W69-01146, and W68-01022).
W71-03010

8C. Hydraulic Machinery

LITTLE FALLS FIBRE CO V HENRY FORD AND SON (LIABILITY FOR LOSS OF POWER HEAD UPSTREAM FROM DAM AND HYDROELECTRIC PLANT).
For primary bibliographic entry see Field 06E.
W71-02844

RELAY COORDINATION FIELD TESTS OF THE 138-KV SYSTEM - COLORADO RIVER STORAGE PROJECT,
Bureau of Reclamation, Denver, Colo.
G. W. Cleaveland.
Bureau of Reclamation Report REC-OCE-70-14, May 1970. 15 p, 6 fig, 3 tab, 5 oscillogram, 2 ref.

Descriptors: *Electric relays, Alternating current, Circuit breakers, Electric arcs, Electrical impedance, Electrical networks, *Coordination, *Faults (Electrical), Hydroelectric plants, Oscillographs, Transmission lines, Substations (Electrical), Switchyards (Electrical), Transmission (Electrical), Powerline carriers, Test procedures.
Identifiers: *Protective relaying, Interconnected systems, Microwave carrier, Transfer tripping, *Staged fault tests, Test results.

Relay coordination staged fault tests were conducted on the Bureau of Reclamation 138-kv system between Flaming Gorge Powerplant and Hayden Substation, Colorado River Storage Project. The tests were particularly important in verifying relay coordination for the 3-terminal line interconnecting the Vernal, SW Rangely, and Hayden Substations. The line uses a direct underreaching transfer trip protective relaying scheme over a microwave channel between Hayden and Vernal and a powerline carrier channel between Vernal and SW Rangely. The tests identified a few incidents of relay misoperation on the Flaming Gorge-Vernal lines, but demonstrated satisfactory operation on the 3-terminal line, including faults at the critical fault location. In addition, the tests demonstrated satisfactory transmission of carrier through a transitory fault. Relay operations, fault current values, and transfer trip clearing and transit times for the staged fault tests are summarized. (USBR)
W71-02845

FIELD TESTING OF EXTRA-HIGH-VOLTAGE CABLES,
Hitachi Cable Ltd., Tokyo (Japan).
N. Ando.
Hitachi Review, Vol 19, No 8, p 293-299, 1970. 7 p, 6 fig, 3 tab, 12 ref.

Descriptors: *Field tests, *Electric cables, *Extra high voltage, Test facilities, Aging (Physical), Performance, Electric currents, Mechanical properties, Electric insulation, Temperature, Foreign research, Sensors, Instrumentation, Simulation, Electrical properties, Test procedures, Stress.
Identifiers: Japan, *Foreign testing, *Pipe-type cables, Temperature rise, Oil-filled cables.

To meet the increasing concentrated power demand in urban districts, extra-high-voltage cables are being introduced. The cables must offer stable long-term performance and good initial performance. Because the cables are installed in construction work on-site and are subjected to greater electrical and mechanical stresses as the voltage increases, various factors inducing aging that are encountered during operation must be predicted if long-term performance is to be guaranteed. To determine aging factors and intensity, long-term voltage and thermal endurance tests, including accelerated aging tests, were conducted. Field tests of extra-high-voltage cables for guaranteeing a long service life are described, with special reference to 275-kv cables. In the tests, in which actual operation is simulated, setting of test conditions is important because the sample must be subjected to severe conditions to find long-term reliability in a short period. Results are described for sample cables and accessories, and considerations for setting of test conditions are discussed. (USBR)
W71-02847

VACUUM FREEZING VAPOR-COMPRESSION PROCESS: 60,000 GPD PILOT PLANT EVALUATION,
Colt Industries, Inc., Beloit, Wis.
For primary bibliographic entry see Field 03A.
W71-02952

HOW TO SELECT AND USE DRILL BITS PROFITABLY,
Delta Drilling Co., Tyler, Tex.
R. R. Hudeck.
World Oil, Vol 169, No 4, p 73-77, September 1969. 7 fig, 1 ref.

Descriptors: *Oil wells, *Rotary drilling, Drilling equipment, Drilling economics.
Identifiers: *Drill-bit economics, Bit life, Bit wear, Bit designs, Bit applications, Trip reduction.

Although rock bit shapes are similar, the angle and length and design of the teeth must change for soft through hard formations. This article describes how to recognize, understand and apply these varied bit designs to best advantage. Understanding and properly applying the many bit designs now available will allow wells to be drilled faster at lower cost. By selecting and using the proper bit and by programing rig performance to match bit capabilities, the contractor can also: (1) drill straighter and safer hole, (2) reduce fishing jobs, (3) improve design of bottom hole assemblies (4) reduce trips and (5) apply optimum weight and rpm if formation characteristics are known. (Campbell-NWWA)
W71-02985

PLAN OF CHIRKEISK HYDROELECTRIC POWERPLANT ON THE SULAK RIVER,
Bureau of Reclamation, Denver, Colo.
I. P. Aleshin.
Translated from: Gidrotekhnicheskoe Stroitel'stvo, No 5, p 13-16, 1962. Available from NTIS as PB-193 769T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 647, March 1969. 15 p, 4 fig.

Descriptors: Project planning, *Underground powerplant, Underground structures, Engineering geology, Tunnels, Penstocks, Electric power costs, Intake towers, *Arch dams, Reservoirs, Concrete structures, Spillways, Limestones, *Hydroelectric powerplants, Flood control, Irrigation, Preliminary investigations, *River basin development, Water management, Draft tubes, *Foreign projects.
Identifiers: Chirkeisk Powerplant (USSR), USSR, Comparative studies, Chirkei hydro proj (USSR), Sulak Cascade System (USSR), Outlet tunnels.

Chirkeisk Dam and Powerplant is the second and an important step in the multipurpose cascade of the Sulak river and its tributaries, flowing down the steep Northern Caucasus slopes across coastal lowlands to the Caspian Sea. The completed cascade through its reservoirs will regulate the rivers to provide power and full water management to the land mass downstream, including flood control, sedimentation, and water for irrigation. Chirkeisk Hydrocomplex consists of a nonoverflow concrete-arch dam, tower intake structure, underground powerplant, outlet tunnel, controlled spillway, and switchyard. Construction is in a narrow gorge, cutting through strongly layered limestones, which when grouted will provide a solid monolithic and impervious foundation. Engineering geology, project planning to select the type of structure most feasible, results of some preliminary surveys and tests, and the structures selected are described.
W71-03194

BRATSK HYDROELECTRIC POWERPLANT,
Bureau of Reclamation, Denver, Colo.
A. D. Sakov, B. Z. Umanskii, and N. I. Fedotov.
Translated from: Elektricheskie Stantsii, No 1, p 7-13, 1963. Available from NTIS as PB-193 591, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 664, July 1966. 25 p, 5 fig.

Descriptors: *Hydroelectric powerplants, Electric currents, Electric cables, *Electrical equipment, Bus (Electrical), Electric generators, *Switchyards (Electrical), Transmission (Electrical), Remote control systems, Telemetry systems, Power system operations, Hydroelectric power, Alternating currents, Powerplants, *Extra high voltage, Electric switches, Power transformers, Voltage regulators, Ammeters, Wattmeters, Circuits, Electric potential, Foreign projects, Foreign design practices, Electrical networks, Excitation, Extra long distance.
Identifiers: Electric conductors, *Bratsk Powerplant (USSR), USSR, Electrical design.

Bratsk Hydrocomplex on the Angara River in Siberia will produce and distribute 4,500 mw of power of 500 kv to the Siberian grid and 220 kv to the regional network and local consumers. This article, written as the first units went on the line, gives concise information on the powerplant, its installations, layout, excitation system, station-service circuits, 220-kv and 500-kv open-air switchyards, control system, power and other electrical equipment and operating personnel. Schematic diagrams of the various circuits, control board layout, and possible operating variations designed to prevent outages are given. Many major electrical components, such as transformers are described and identified by type and number.
W71-03196

8D. Soil Mechanics

IN-PLACE TREATMENT OF FOUNDATION SOILS,
California Univ., Berkeley.
J. K. Mitchell.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM1, p 73-110, Jan 1970. 38 p, 21 fig, 5 tab, 88 ref, append.

Descriptors: Blasts, Chemical stability, Compaction, *Electro-osmosis, *Foundations, *Grouting, Piles (Foundations), Relative density, Soil mechanics, Soil stabilization, Bibliographies.
Identifiers: Vibroflotation, Electrokinetic potential.

The state-of-the-art of 7 special methods for treating soils to support structures is reviewed. Vibroflotation, Compaction piles, blasting, and grouting are limited mainly to the treatment of cohesionless soils; electro-osmosis, thermal treatment, and treatment with additives find primary application in the treatment of cohesive soils. Although blasting is usually the fastest and least expensive, compared with vibroflotation and compaction piles, the results are the least certain. Installation of stone column piles by vibroflotation has extended the range of application of this method into cohesive soils. Recently developed chemical grouts are now approaching the ideal in terms of viscosity and control of setting time. Mixed-in-place intrusion grouting appears to be a promising technique for constructing soil-cement piles in place. Additive stabilization of foundation soils for structures is used mainly in connection with grouting and electro-osmosis, with additional application to the treatment of expansive soils to shallow depths. Has 88 references. (USBR)
W71-02857

SHORT PERIOD VARIATION IN LAND SUBSIDENCE,
Tokyo, Japan.
For primary bibliographic entry see Field 02F.
W71-02906

ON THE INFLUENCE OF OCEANIC TIDES UPON ARTESIAN HEAD AND SURFACE LEVEL OF LAND,
Saitama Univ., Urawa (Japan). Dept. of Science and Technology.
For primary bibliographic entry see Field 02F.
W71-02907

LAND SUBSIDENCE; PROCEEDINGS OF THE TOKYO SYMPOSIUM, SEPTEMBER 1969.
For primary bibliographic entry see Field 02F.
W71-03148

DIRECTIONS OF RESEARCH ON LAND SUBSIDENCE,
Komazawa Univ., Tokyo (Japan).
For primary bibliographic entry see Field 02F.
W71-03149

STATUS OF PRESENT KNOWLEDGE AND NEEDS FOR ADDITIONAL RESEARCH ON COMPACTION OF AQUIFER SYSTEMS,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03150

LAND SUBSIDENCE PROBLEMS IN TAIPEI BASIN,
For primary bibliographic entry see Field 02F.
W71-03151

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, Tex.
For primary bibliographic entry see Field 02F.
W71-03152

SURFACE DEFORMATION ASSOCIATED WITH OIL AND GAS FIELD OPERATIONS IN THE UNITED STATES,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02F.
W71-03153

SUBSIDENCE IN THE WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.,
Long Beach Dept. of Oil Properties, Calif.
For primary bibliographic entry see Field 02F.
W71-03154

LAND SUBSIDENCE IN THE TOKYO DELTAIC PLAIN,
Tokyo Metropolitan Univ. (Japan). Dept. of Science and Engineering.
For primary bibliographic entry see Field 02F.
W71-03155

REVIEWS OF LAND SUBSIDENCE RESEARCHES IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan).
For primary bibliographic entry see Field 02F.
W71-03156

RESULTS OF REPEATED PRECISE LEVELLINGS IN LAND SUBSIDENCE AREA IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ. (Tokyo).
For primary bibliographic entry see Field 02F.
W71-03157

LAND SUBSIDENCE IN OSAKA,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02F.
W71-03158

ANALYSIS OF LAND SUBSIDENCE IN NIIGATA,
Ministry of Transportation, Yokosuka (Japan). Port and Harbor Research Inst.
For primary bibliographic entry see Field 02F.
W71-03159

TRITIUM DATING OF LAND SUBSIDENCE IN NIIGATA,
For primary bibliographic entry see Field 02F.
W71-03160

SHRINKAGE OF SUBAQUEOUS SEDIMENTS OF LAKE IJSSEL (THE NETHERLANDS) AFTER RECLAMATION,
Yssel Lake Development Authority, Kampen (Netherlands).
For primary bibliographic entry see Field 02F.
W71-03161

THE HYDROLOGIC BALANCE IN THE LAND SUBSIDENCE PHENOMENA,
Research Inst. for Natural Resources, Tokyo (Japan); Kokusai Aerial Surveys Co. Ltd., Tokyo (Japan); and Tokyo Univ. (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03162

NIIGATA GROUND SUBSIDENCE AND GROUNDWATER CHANGE,
For primary bibliographic entry see Field 02F.
W71-03163

SUBSIDENCE IN THE NORTH GERMAN COASTAL REGION,
For primary bibliographic entry see Field 02F.
W71-03164

A LINEAR RELATIONSHIP BETWEEN LIQUID PRODUCTION AND OIL-FIELD SUBSIDENCE,
Geological Survey, Menlo Park.
For primary bibliographic entry see Field 02F.
W71-03165

EFFECTS OF MINING SUBSIDENCES ON THE GROUNDWATER AND REMEDIAL MEASURES,
Bochum Univ. (West Germany).
For primary bibliographic entry see Field 02F.
W71-03166

SURFACE SUBSIDENCE AND SINKHOLES IN THE DOLOMITIC AREAS OF THE FAR WEST RAND, TRANSVAAL, REPUBLIC OF SOUTH AFRICA,
Dept. of Mines, Johannesburg (South Africa); and Geological Survey, Pretoria (South Africa).
For primary bibliographic entry see Field 02F.
W71-03167

DAMAGE TO IRRIGATION POND DUE TO MINING SUBSIDENCE,
Kyushu Univ., Fukuoka City (Japan). Research Inst. of Science and Industry.
For primary bibliographic entry see Field 02F.
W71-03168

ON THE COMPRESSION SUBSIDENCE OF PEAT AND HUMIC LAYERS IN THE KAMI-SHINBASHI AREA, KURATE-MACHI, KURATE-GUN, FUKUOKA PREFECTURE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03169

SMALL SINKING HOLES IN LIMESTONE AREA WITH SPECIAL REFERENCE TO DRAINAGE OF COAL MINES,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03170

CONSOLIDATION PHENOMENON CAUSED BY MINE DRAINAGE IN THE AREA OUTLYING FROM WORKING PLACE,
Kyushu Univ., Fukuoka (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02F.
W71-03171

MODEL STUDIES OF DIFFERENTIAL COMPACTION,
Georgia Univ., Athens.
For primary bibliographic entry see Field 02F.
W71-03172

MODEL EXPERIMENTS ON LAND SUBSIDENCE,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02F.
W71-03173

ANALYSIS OF BOREHOLE EXTENSOMETER DATA FROM CENTRAL CALIFORNIA,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
W71-03174

THE MECHANICS OF COMPACTION AND REBOUND, WILMINGTON OIL FIELD, LONG BEACH, CALIFORNIA, U.S.A.
Long Beach Dept. of Oil Properties, Calif.
For primary bibliographic entry see Field 02F.
W71-03175

OBSERVATION OF COMPACTION OF FORMATION IN THE LAND SUBSIDENCE OF NIIGATA CITY,
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W71-03176

FINITE ELEMENT ANALYSIS OF LAND SUBSIDENCE,
Ohio State Univ., Columbus. Dept. of Civil Engineering; and California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03177

SAND COMPRESSION AS A FACTOR IN OIL FIELD SUBSIDENCE,
San Jose State Coll., Calif. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W71-03178

COMPRESSIBILITIES OF CLAYS AND SOME MEANS OF PREDICTING AND PREVENTING SUBSIDENCE,
University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 02F.
W71-03179

SOIL-WATER DISEQUILIBRIUM AS A CAUSE OF SUBSIDENCE IN NATURAL SOILS AND EARTH EMBANKMENTS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Soil Mechanics.
For primary bibliographic entry see Field 02F.

W71-03180

STUDIES ON PARTIAL COMPACTION OF SOIL LAYER IN REFERENCE TO LAND SUBSIDENCE IN TOKYO,
Tokyo Inst. of Civil Engineering (Japan); and Komazawa Univ., Tokyo (Japan).
For primary bibliographic entry see Field 02F.
W71-03181

SHORT-TERM MOVEMENT OF THE LAND SURFACE NEAR WATER WELLS,
Hawaii Univ., Honolulu. Dept. of Geosciences.
For primary bibliographic entry see Field 02F.
W71-03182

MODERN ROCKFILL DAMS, INCLUDING ROCKFILL REINFORCED EARTH DAMS: PLANNING, DESIGN AND CONSTRUCTION,
National Science Foundation, Washington, D.C.
R. A. Airapetyan.
Transl. of Proektirovanie Kamennonabeosnykh I Kamennozemlyanykh Plotin, Moscow 1968. Available from NTIS as TT-70-50024, $3.00 in paper copy, $0.95 in microfiche. Israel Program for Scientific Translations, Jerusalem, 1970. 205 p.
Identifiers: *Rockfill dams, Design criteria, Earth dams, Slope protection, Curtain walls, Polymeric films, Stability methods, Pore pressure, Structural analysis, Soil dynamics, USSR, Translations.

The book deals with the principal design and construction problems of modern rockfill and rockfill-reinforced earth dams. In providing a detailed review of dams built in the last hundred years and an analysis of the design and construction principals of recently built dams, the author offers guidelines on the choice of type, design and materials for rockfill dams, as well as on their analysis and the required computations. The author mainly dwells on questions applying to high and 'super-high' dams, such as are being built on a large scale at present. Appendices provide the principal data on 56 dams, completed or under construction, and descriptions of 13 of the most remarkable of them.
W71-03197

8E. Rock Mechanics and Geology

ROCK MECHANICS TESTING AS RELATED TO MICA POWER FACILITIES,
CASECO Consultants Ltd., Vancouver (British Columbia).
P. Meidal, and J. L. Webster.
Engineering Journal (Canada), Vol 53, No 7, p 11-20, July 1970. 10 p, 9 fig, 4 ref, 2 disc.

Descriptors: *Rock mechanics, Rock properties, Foreign projects, Test procedures, *Underground powerplants, Engineering geology, Exploration, Tunnels, Tunnel pressures, Laboratory tests, Foreign construction, Testing.
Identifiers: *Rock tests, Underground openings, Plate load tests, Mica Dam, Canada, Borehole extensometers, Flat jack method, *In situ tests.

Rock mechanics testing in an exploratory tunnel excavated into the location of the proposed underground powerhouse at Mica Dam in Canada is described. Geological investigations and in situ and laboratory tests were made to determine the elastic and inelastic properties of the rock. Flat jacks, borehole deformation meter, borehole extensometers, and steel sets instrumented with load cells were used, and plate loading tests and measurements by precise survey methods were made. Results and their influence on the design of underground structures are discussed. Modifications to the powerhouse arrangement, selected on the basis of preliminary investigations, are described; additional work required to determine the optimum shape of the underground openings is outlined. (USBR)
W71-02846

8F. Concrete

GUIDE TO JOINT SEALANTS FOR CONCRETE STRUCTURES.
American Concrete Inst., Detroit, Mich.

Journal of American Concrete Institute, Proceedings Vol 67, No 7, p 489-536, July 1970. 48 p, 27 fig, 5 tab, 14 ref. 3 append.

Descriptors: *Joint fillers, *Sealing compounds, *Concrete structures, *Joints (Connections), Concrete construction, Construction joints, Tanks (Containers), Concrete pipes, Concrete dams, Cracking, Mastics, Precast concrete, Reinforced concrete, Thermoplastics, Repairing, Linings, Seals (Stoppers), Concretes, Expansion joints, Buildings, Gaskets, Performance.
Identifiers: Compression joint seals, Concrete pavements, Concrete slabs, Control joints, Thermosetting resins.

Most joints and some cracks in concrete structures require sealing against the adverse effects of environmental and service conditions. The report is a guide to better understanding properties of joint sealants and where and how they are used in present practice. Described and illustrated are: (1) the functioning of joint sealants; (2) required properties, available materials, and applicable specifications for field-molded sealants and preformed sealants such as waterstops, gaskets, or compression seals; (3) determination of joint movements, widths, and depths; (4) outline details of joints and sealants used in general structures, fluid containers, and pavements; (5) methods and equipment for sealant installation including preparatory work; (6) performance of sealants; and (7) methods of repairing defective work or maintenance resealing. Improvements needed to ensure better joint sealing in the future are indicated. (USBR)
W71-02849

ALLOWABLE TENSILE STRESSES FOR PRESTRESSED CONCRETE.
Prestressed Concrete Inst., Chicago, Ill. Committee on Allowable Stresses in Presstressed Concrete Design.

Journal of Prestressed Concrete Institute, Vol 15, No 1, p 37-42, Feb 1970. 6 p, 3 fig, 2 tab, 3 ref.

Descriptors: *Tensile stress, *Prestressed concrete, Laboratory tests, *Beams (Structural), Structural members, Structural design, Deflection, Structural engineering, *Building codes, Structural behavior, Overloads, Cracking, Design standards, Safety factors.
Identifiers: *Allowable stress, American Concrete Inst, Analytical method, Camber.

Some provisions of the 1963 ACI Building Code kept prestressed concrete from meeting the serviceability requirements. Work of the PCI Committee, formed to recommend higher allowable tensile stresses in prestressed concrete flexural members while maintaining serviceability requirements, was largely responsible for changes in allowable stresses in the draft of the revised ACI code presented in the Feb 1970 ACI Journal. Rationale behind the use of higher allowable tensile stresses is given. Historically, serviceability of prestressed concrete beams has been controlled by specifying allowable stresses. Use of stress limits will not always provide satisfactory behavior. Two extreme cases are: (1) camber growth caused by small allowable tensile stress and large temporary loads; and (2) unsatisfactory deflection behavior caused by loss of stiffness when loaded above the cracking level. In view of these extremes, any recommended allowable tensile stress depends on the deflection characteristics of the beam above and below the cracking load. A simplified method of determining an allowable tensile stress, with a bilinear assumption of load-deflection behavior, and based on the post-cracking behavior of bonded prestressed concrete beams, is presented. (USBR)
W71-02851

EARTHQUAKE RESPONSE OF CONCRETE GRAVITY DAMS,
California Univ., Berkeley.
For primary bibliographic entry see Field 08A.
W71-02853

SLAB BRIDGE DESIGN AND DRAWING--AN AUTOMATED PROCESS,
Atkins (W. S.) and Partners.
For primary bibliographic entry see Field 08A.
W71-02854

8G. Materials

DURABILITY OF POLYMER FILM SEEPAGE SHIELDS,
Bureau of Reclamation, Denver, Colo.
V. V. Sokolskaya.
Translated from: Gidrotekhnicheskoe Stroitel'stvo, No 11, p 18-21, 1969, Bound with original text. Available from NTIS as PB-193 664T, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 836, March 1970. 7 p, 12 fig, 1 tab, 6 ref.

Descriptors: *Polymers, *Films, *Durability, *Hydraulic structures, Seepage, Shields, Construction materials, Waterproofing, Linings, Materials stability.
Identifiers: *Seepage control.

Experience with the polymer film seepage shields in hydrotechnical construction are technically and economically sound. Seepage practically ceases in constructions with such shields and their technology is simple. In the Soviet Union, polymer film shields were introduced in the irrigation canals of the Golodnaya Steppe in 1958. At present, many institutes of research and design, as well as construction organizations, are engaged in designing and making seepage shields from film polymers for water-storage reservoirs, dams of native material, brine storage reservoirs, and sludge dumps.
W71-03193

8H. Rapid Excavation

TECHNICAL PLAN FOR EXPLOSIVE CONSTRUCTION OF BAIPAZINSK DAM ON THE VAKHSH RIVER,
Bureau of Reclamation, Denver, Colo.
E. N. Agareva.
Translated from the Russian: Trudy V sessii uchenogo soveta po narodnokhoziaistvennomu ispol'zovaniiu vzryva, Akademiia nauk Kirgizskoi SSR, Frunze, p 254-258, 1965. Available from NTIS as PB-193 767, $3.00 in paper copy, $0.95 in microfiche. Bureau of Reclamation Translation, No 780, September 1968. 11 p, 4 fig.

Descriptors: Foreign design practices, Foreign projects, *Explosions, Explosives, *Rockfill dams, Diversion dams, Tunnels, Charges (Explosives), Limestones, Spillways, Construction, Construction costs, Economics, Gradation, Gravels, Fragmentation, Project planning, *River closures, Safety factors, Dam design.
Identifiers: USSR, Baipazinsk Dam (USSR), Vakhsh River (USSR), *Explosive construction, Nurek Powerplant (USSR), *Slide dams.

The USSR plans to construct a rockfill dam by exploding rock across the Vakhsh River in Tadzhikistan below Nurek Hydropowerplant to divert irrigation water to the Iavansk and Obi-Kuksk Valleys. The 55-m-high nonoverflow dam, containing 622,000 cu meters of excavated materials, will be formed by fracturing and moving a total volume of 1,470,000 cu meters of layered limestone from the steep right bank into the riverbed. Discharge in March, time of the explosions, is 200-400 cu meters per second and velocity 3-5 meters per second. A spillway with four 10-m-wide openings, sluice, stilling basin, and feeder and drainage canals will be constructed before exploding the dam. A

concrete-lined diversion tunnel, 7.5 km long and 5.1 m in diameter, is to be built on the right bank.
W71-03195

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Available from NTIS as PB-196 645, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute Report No. 4 (Revised), July 1, 1970. 97 p. OWRR Project A-999-NC (19).

This report summarizes all water-related studies and research currently underway in North Carolina. It includes federal and state agencies, private industry, and all of the State's senior colleges and universities. Project summaries include organization, investigator (for universities), descriptions, and starting and estimated completion dates.
W71-03075

WATER RESOURCES RESEARCH INTERESTS IN THE COLLEGES AND UNIVERSITIES OF NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
David H. Howells.
Available from NTIS as PB-196 646, $3.00 in paper copy, $0.95 in microfiche. Water Resources Research Institute Report No. 3 (revised), July 1, 1970. 36 p, OWRR Project A-999-NC (18).

An inventory of water-related research interests in the following North Carolina colleges and universities: Consolidated University of North Carolina, including North Carolina State University at Raleigh, University of North Carolina at Chapel Hill, University of North Carolina at Charlotte, University of North Carolina at Greensboro; Campbell College; Duke University; East Carolina University; Guilford College; North Carolina Central University at Durham; and Western Carolina University. This report is revised annually.
W71-03076

9D. Grants, Contracts, and Research Act Allotments

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W71-03075

WATER RESOURCES RESEARCH INTERESTS IN THE COLLEGES AND UNIVERSITIES OF NORTH CAROLINA,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 09A.
W71-03076

10. SCIENTIFIC AND TECHNICAL INFORMATION

SEDIMENTATION ENGINEERING, CHAPTER IV. SEDIMENT SOURCES AND SEDIMENT YIELDS.
American Society of Civil Engineers, New York.
For primary bibliographic entry see Field 02J.
W71-02855

IN-PLACE TREATMENT OF FOUNDATION SOILS,
California Univ., Berkeley.
For primary bibliographic entry see Field 08D.
W71-02857

AN ASSESSMENT OF OPTIMIZATION TECHNIQUES AS APPLIED TO WATER RESOURCE SYSTEMS,
Environmental Dynamics, Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 06A.
W71-02878

ECONOMIC AND TECHNICAL ASPECTS OF THE USE OF MATHEMATICAL MODELS IN STATE WATER RESOURCES PLANNING PROGRAMS,
Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 06A.
W71-02879

SUMMARY OF THE LITERATURE ON THE INORGANIC GEOCHEMISTRY OF MERCURY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-02887

ANNOTATED BIBLIOGRAPHY OF REPORTS, STUDIES, AND INVESTIGATIONS RELATING TO SATELLITE HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
For primary bibliographic entry see Field 02A.
W71-02955

HYDROLOGY OF LIMESTONE TERRANES - ANNOTATED BIBLIOGRAPHY OF CARBONATE ROCKS,
Alabama Geological Survey, University.
For primary bibliographic entry see Field 02F.
W71-03109

ANNOTATED BIBLIOGRAPHY ON ARTIFICIAL RECHARGE OF GROUNDWATER, 1955-67,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W71-03130

WASTE WATER RECLAMATION USING GROUNDWATER RECHARGE - A REVIEW,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 04B.
W71-03136

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A. Center of Competence		
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University of Wisconsin - Eutrophication	W71-03021--03025 03027--03029 03031--03040 03042--03048 03053--03057 03051	31
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C. Other		
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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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